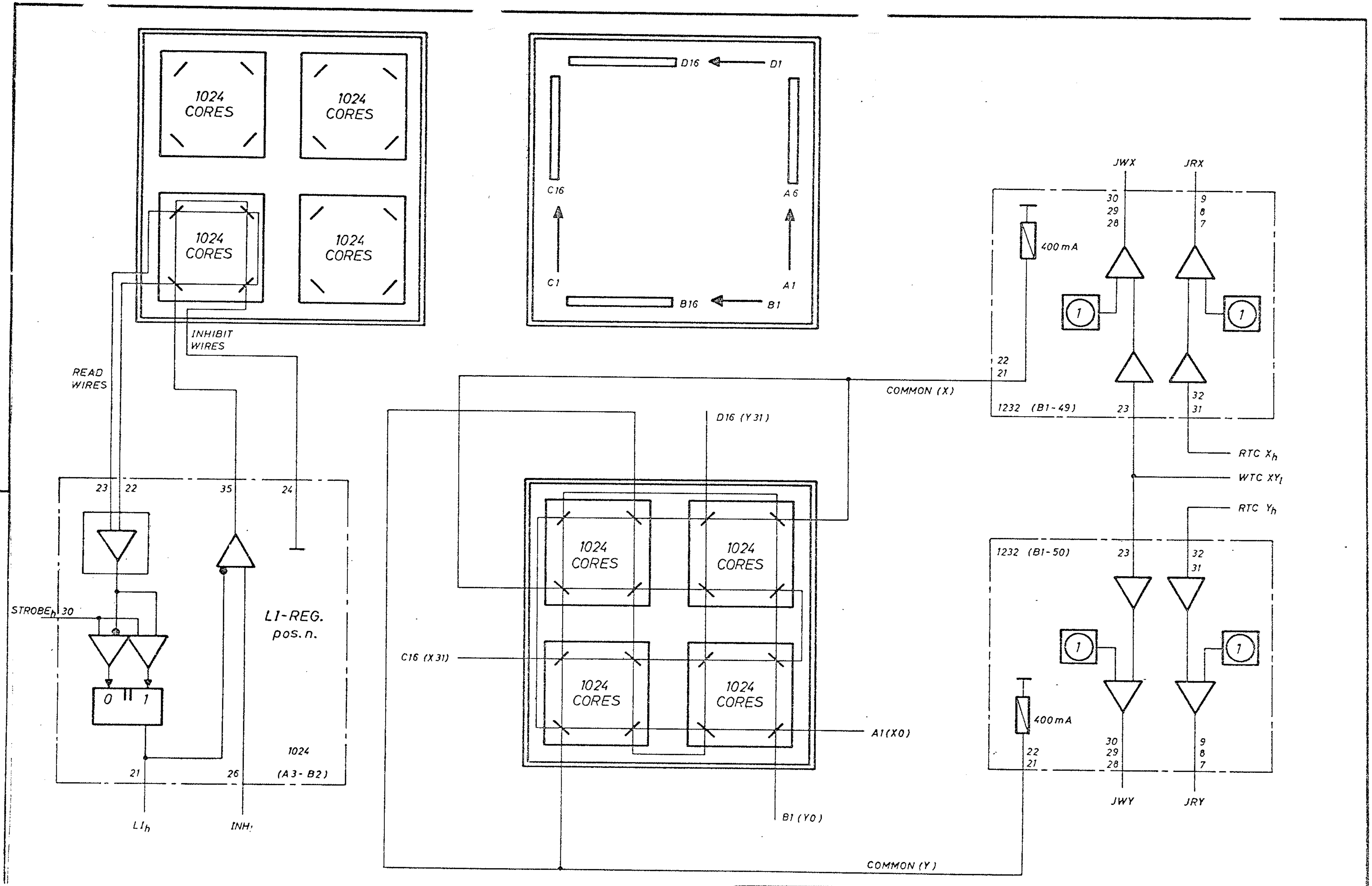
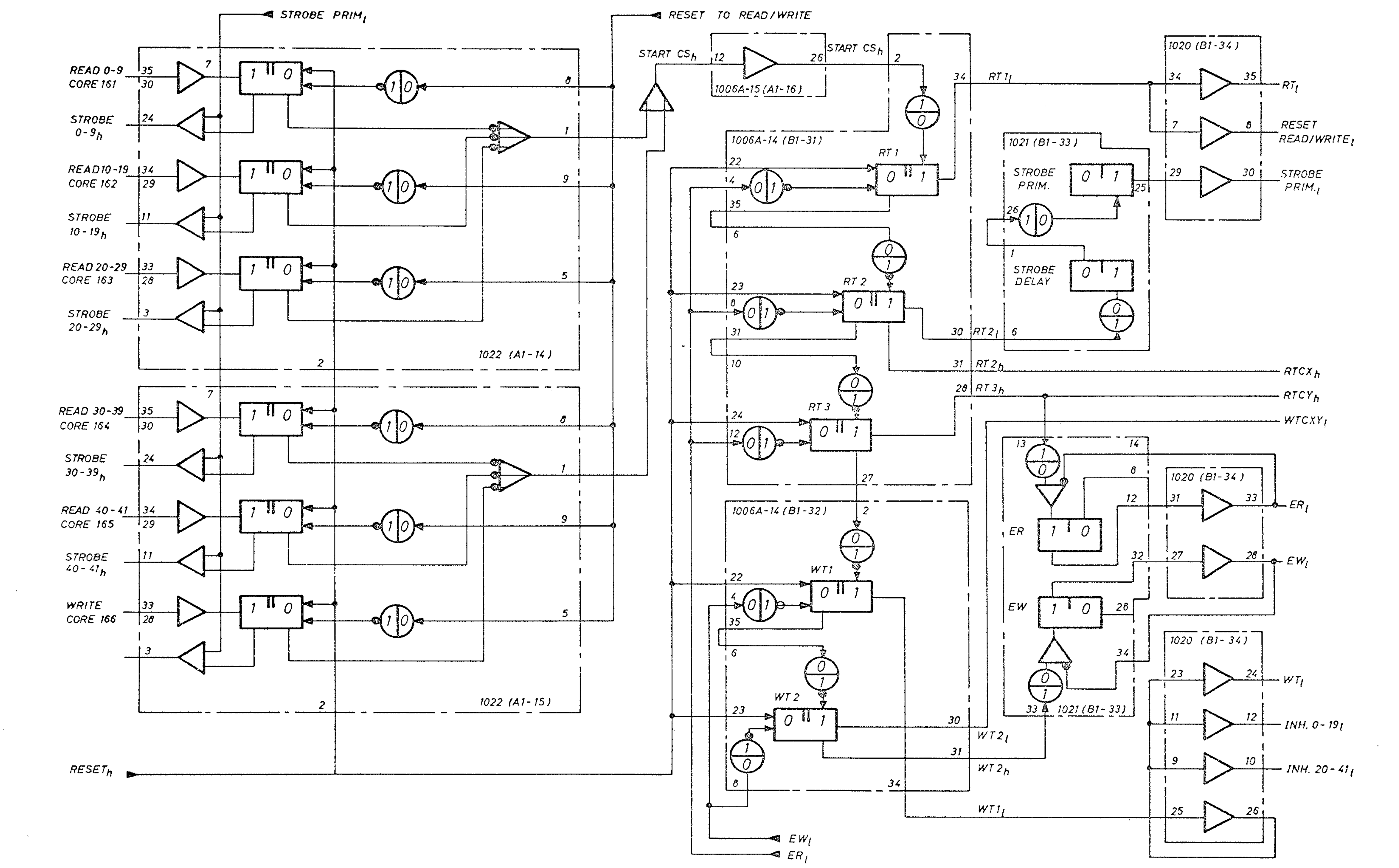
5. Core Store

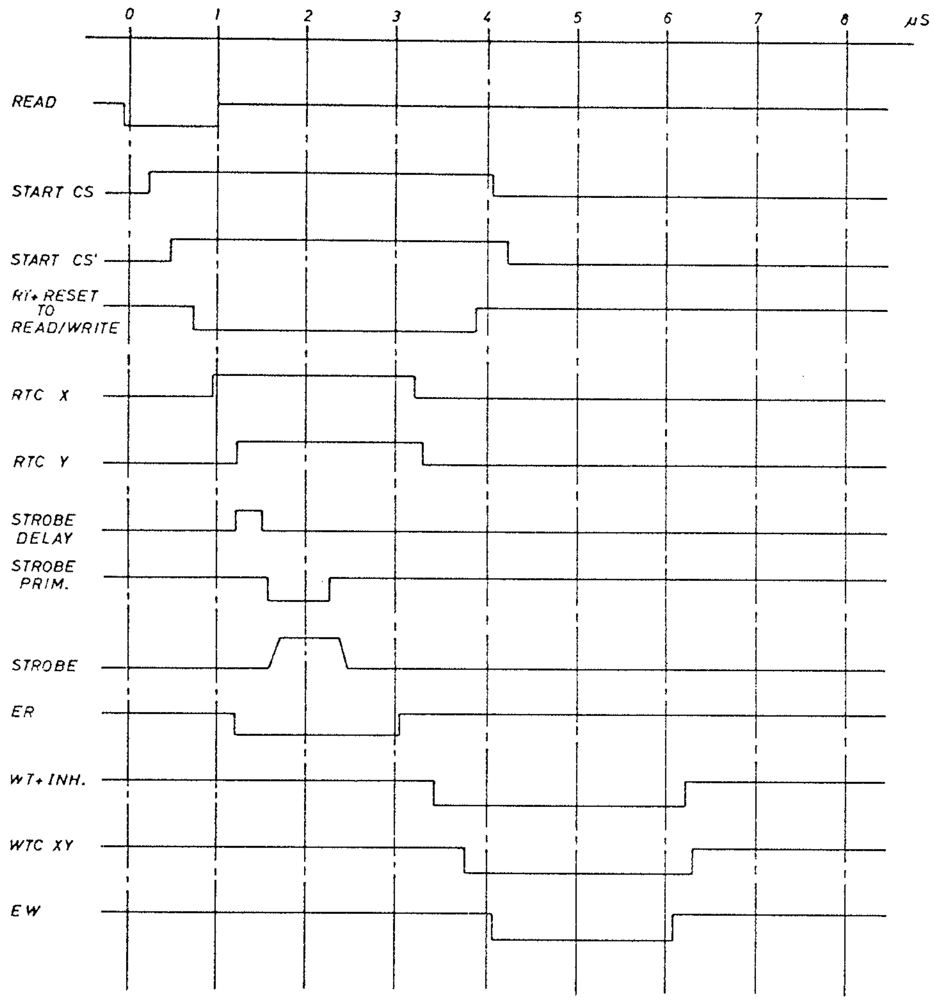
The timing-circuits for the core-store are controlled by means of 6 flip-flops (card 1022) one for each type of core-store functions, as seen from the microprograms. These signals are coded together to a central start-signal: Start CS, which will originate a number of pulses spaced in time (RT, WT, Strobe prim. etc.) The timing is shown in the timing-schedule.
As seen from the CS-Decoding-System diagram (Vol-1), the 10-bits register AD1 is divided in 4 groups: 2 groups controlling the y-wires and 2 groups controlling the x-wires. The cards 1002-1 are decoding the 3-bits-groups. The signals from the decoding-cards are wired to the matrix-drivers (cards 1001-1), where the final decoding is found. The matrix-drivers gates the drive-current (cards 1023) to the selected wire.

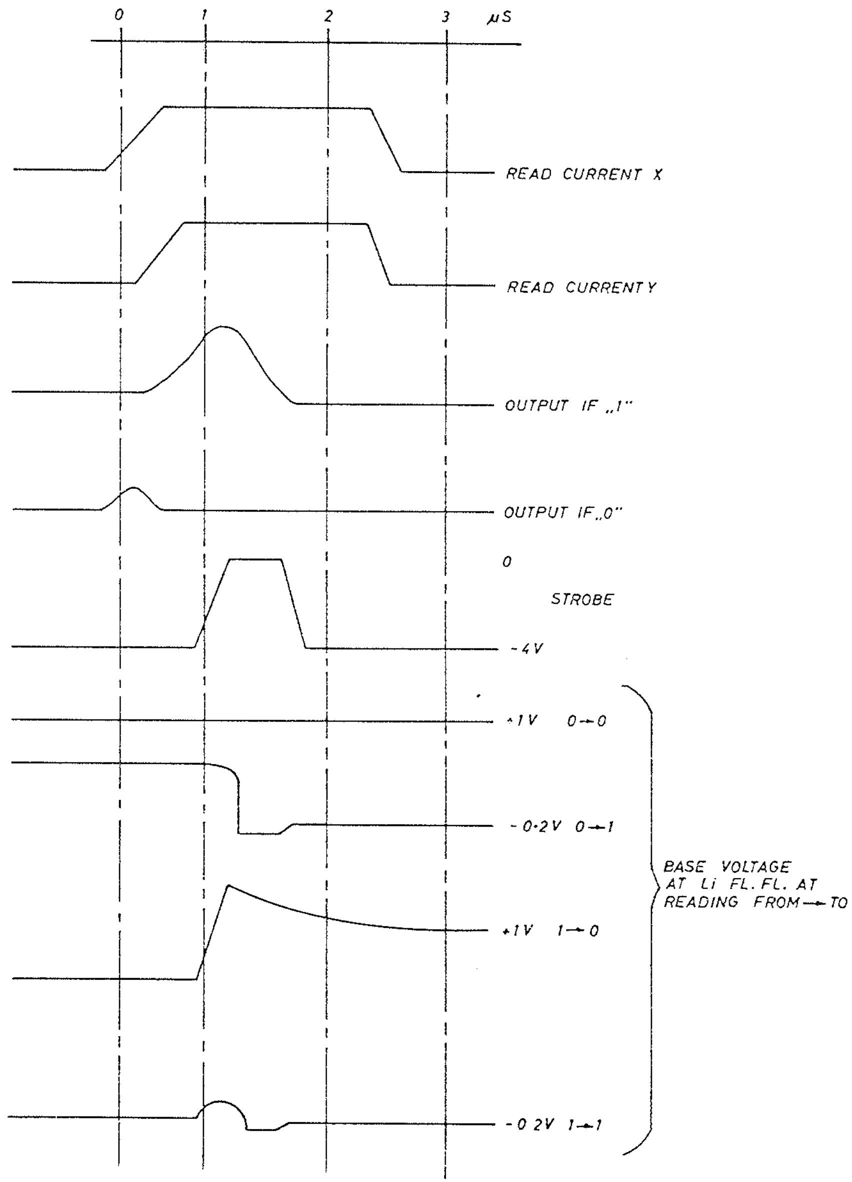


Unit GIER 6	Designed K.H.	CORE STORE.	Drawing No
REGNECENTRALEN	Approved		Drawn by G.T. 10.2.67
	Checked 1.2.62.		Checked F.E. 26-2-67
	Last Revision		1 Sheets Sheet 1

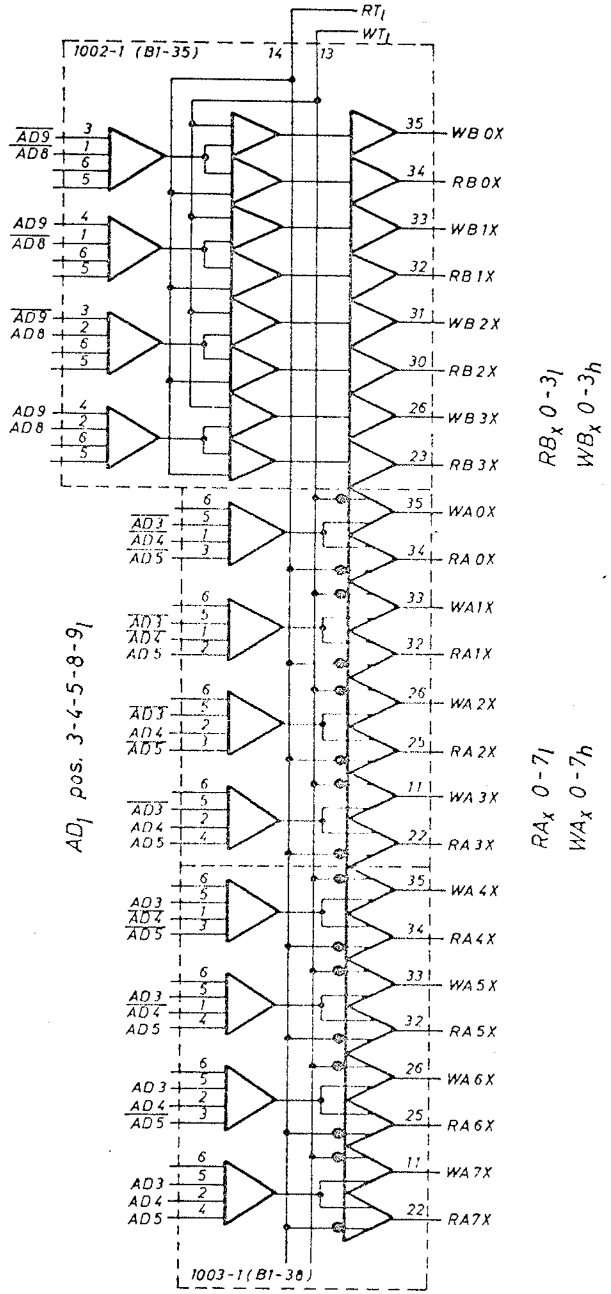


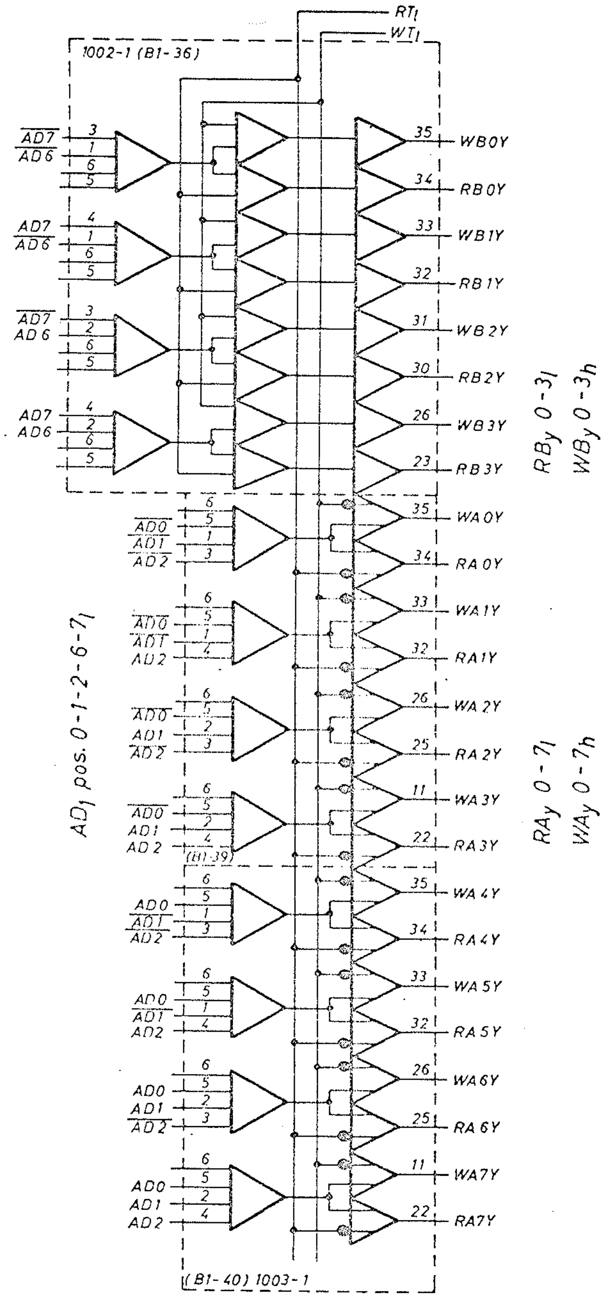
Unit GIER 6	Designed H.I.	CS TIMING	Drawing No
REGNECENTRALEN	Approved		Drawn by G.T. 26.1.67.
	Checked 1.2.62.		Checked F.E. 26-2-67
	Last Revision		1 Sheets / Sheet 1



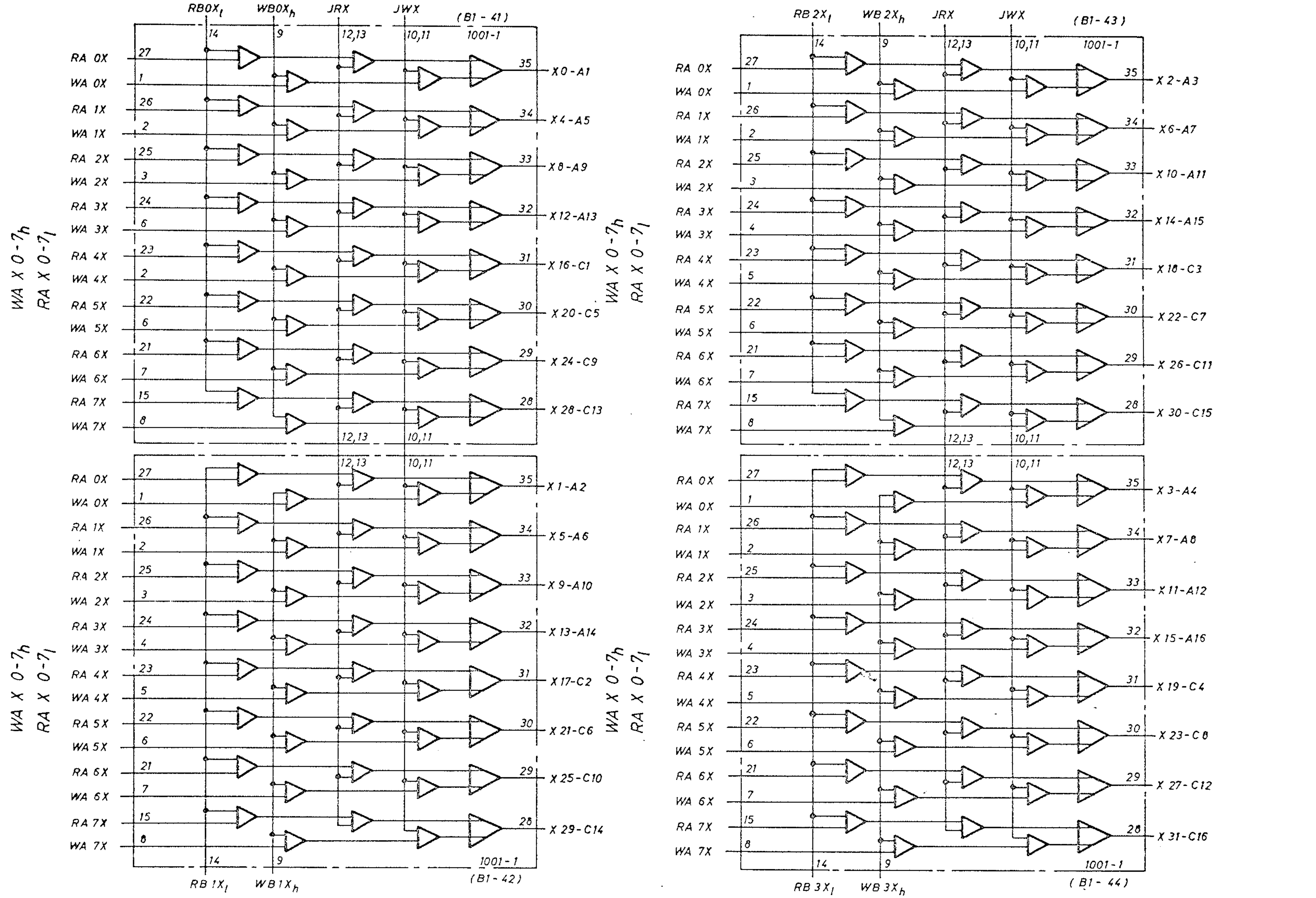


Unit GIER 6	Designed K.H.	CS TIMING SCHEDULE.	Drawing No
REGNECENTRALEN	Approved		Drawn by G.T. 10 2 67
	Checked 1. 2. 62.		Checked F E 26-2-67
	Last Revision		1 Sheets · Sheet 1

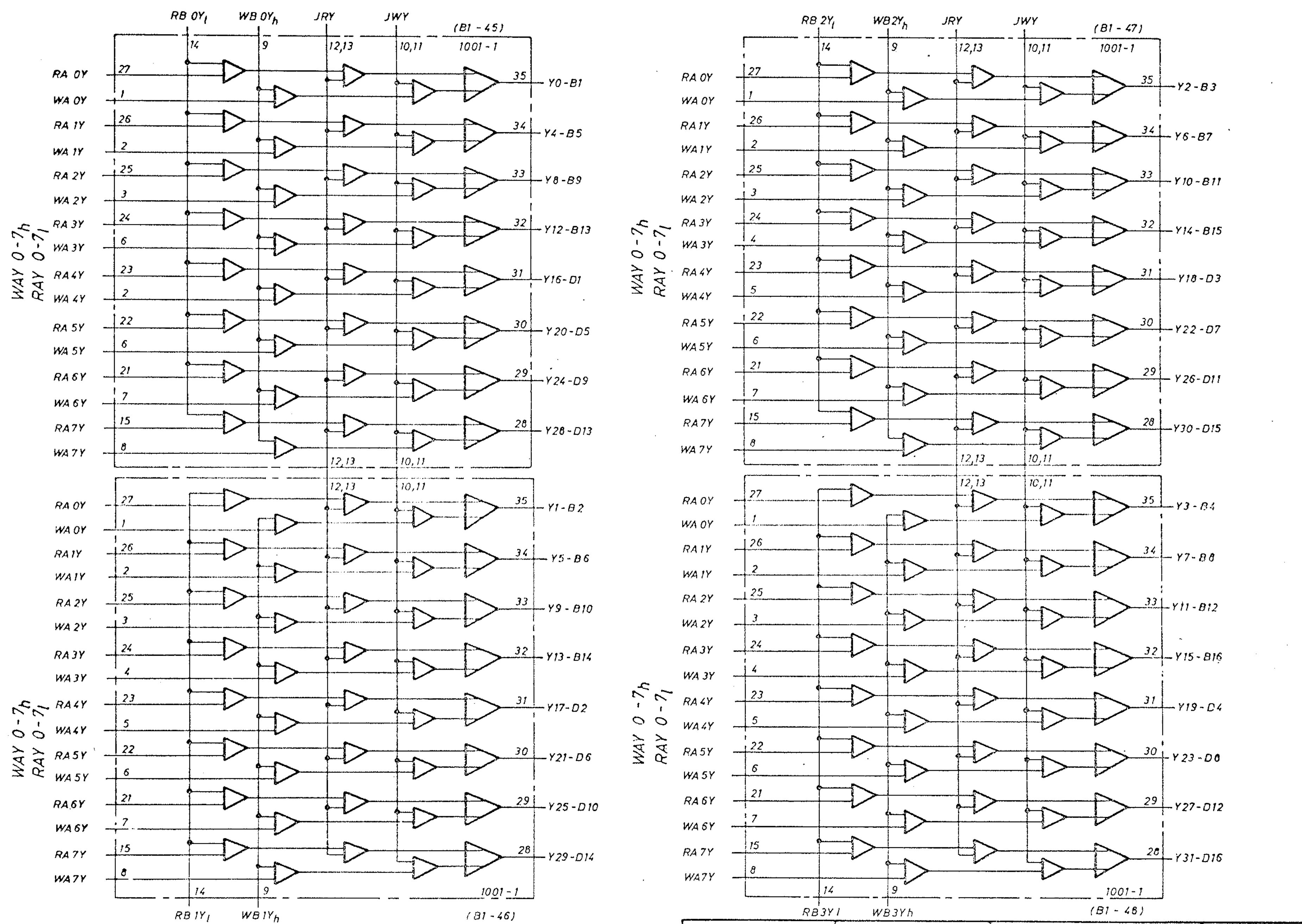




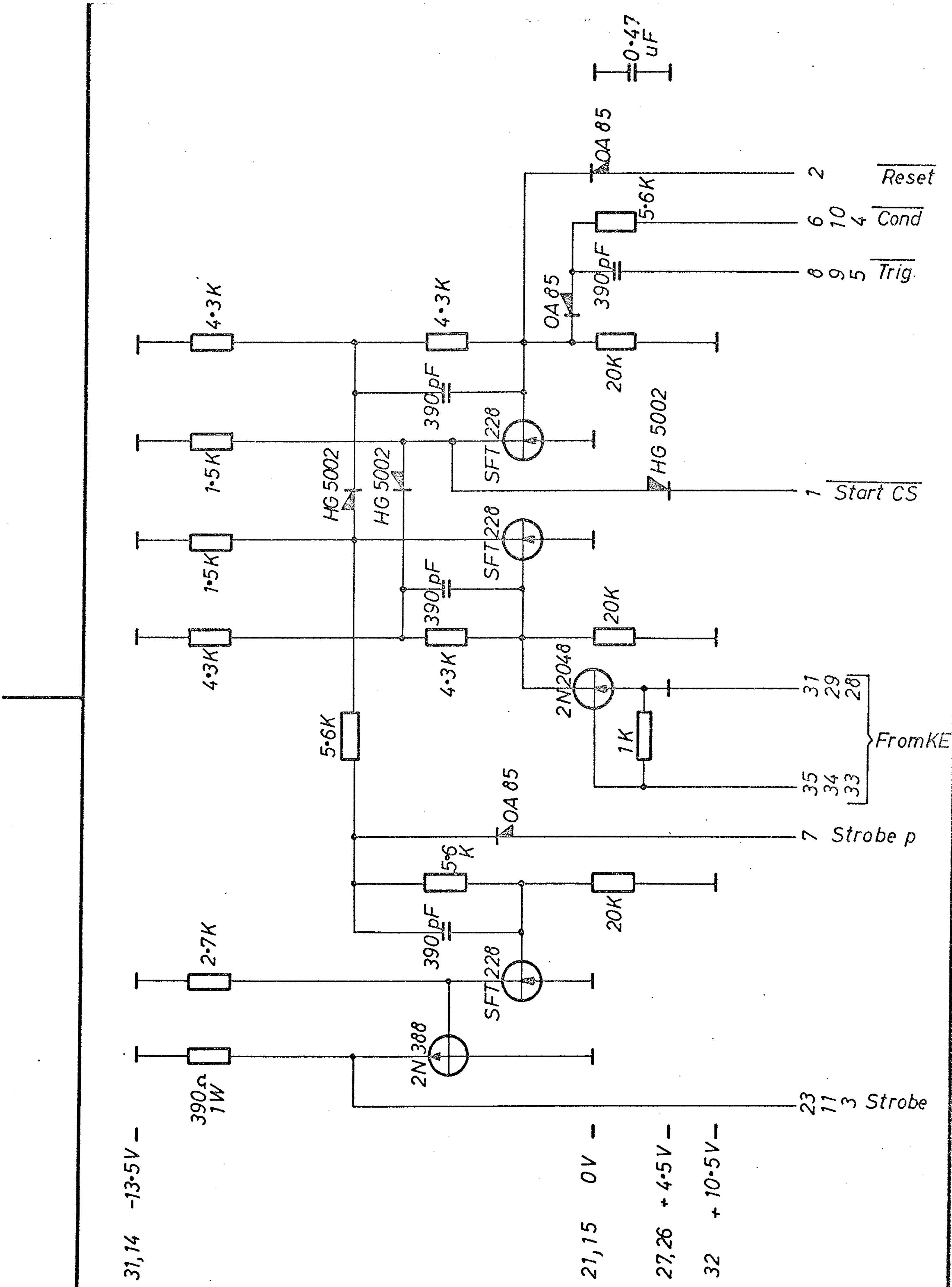
Unit GIER 6	Designed K.H.	CS DECODING.	Drawing No
REGNECENTRALEN	Approved		Drawn by G.T. 8.2.67.
	Checked 1.2.62.		Checked F.E. 26-2-67
	Last Revision		1 Sheets Sheet 1



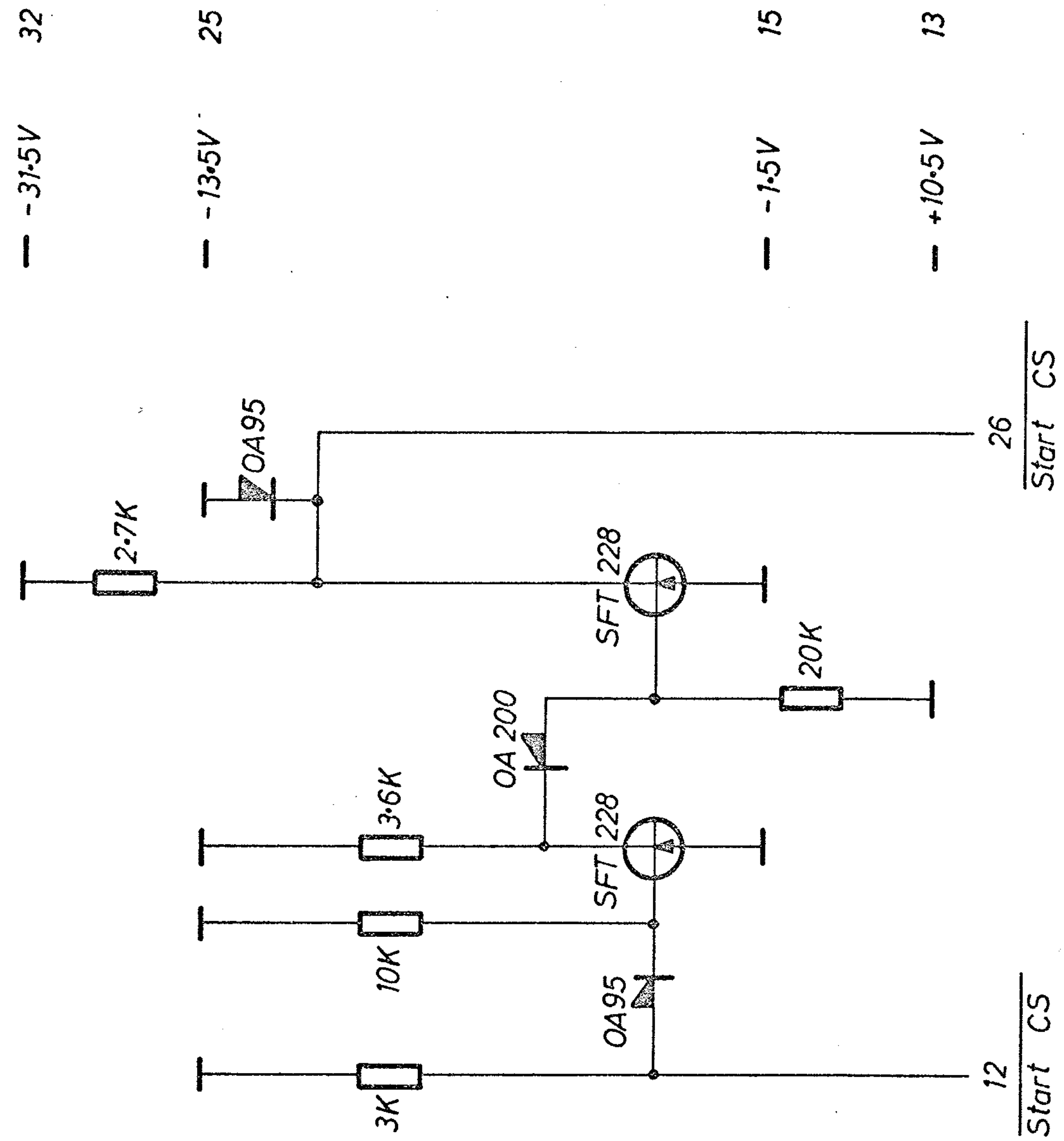
Unit GIER 6	Designed K.H.	CS MATRIX DRIVER X.	Drawing No
REGNECENTRALEN	Approved		Drawn by G.T. 2.1.67.
	Checked 1.2.62.		Checked F.E. 26-2-67
	Last Revision		1 Sheets, Sheet 1



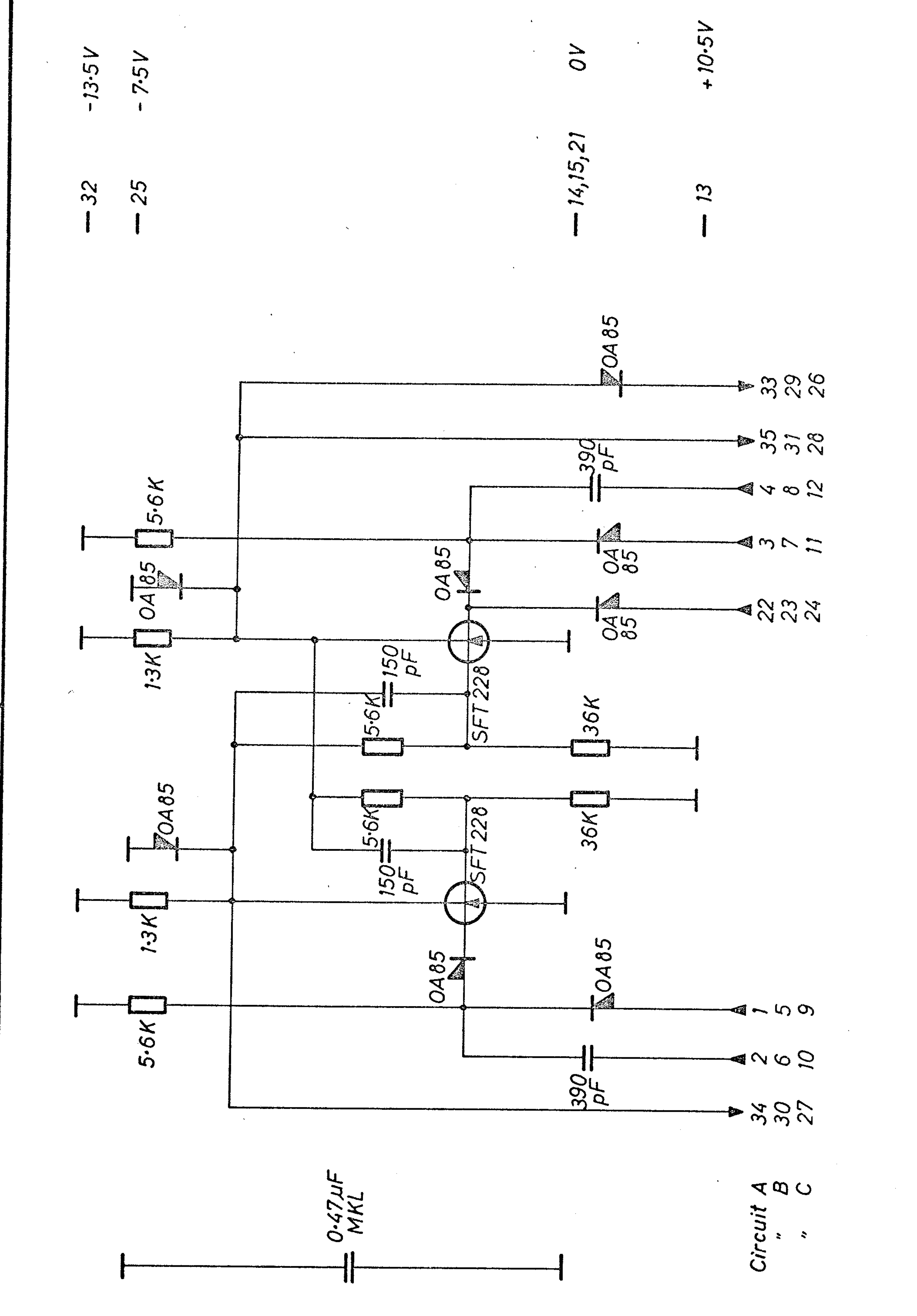
Unit GIER 6	Designed K.H.	CS MATRIX DRIVER Y.	Drawing No
REGNECENTRALEN	Approved		Drawn by G.T. 14.2.67.
	Checked 1.2.62.		Checked F.E. 26-2-67
	Last Revision		1 Sheets / Sheet 1



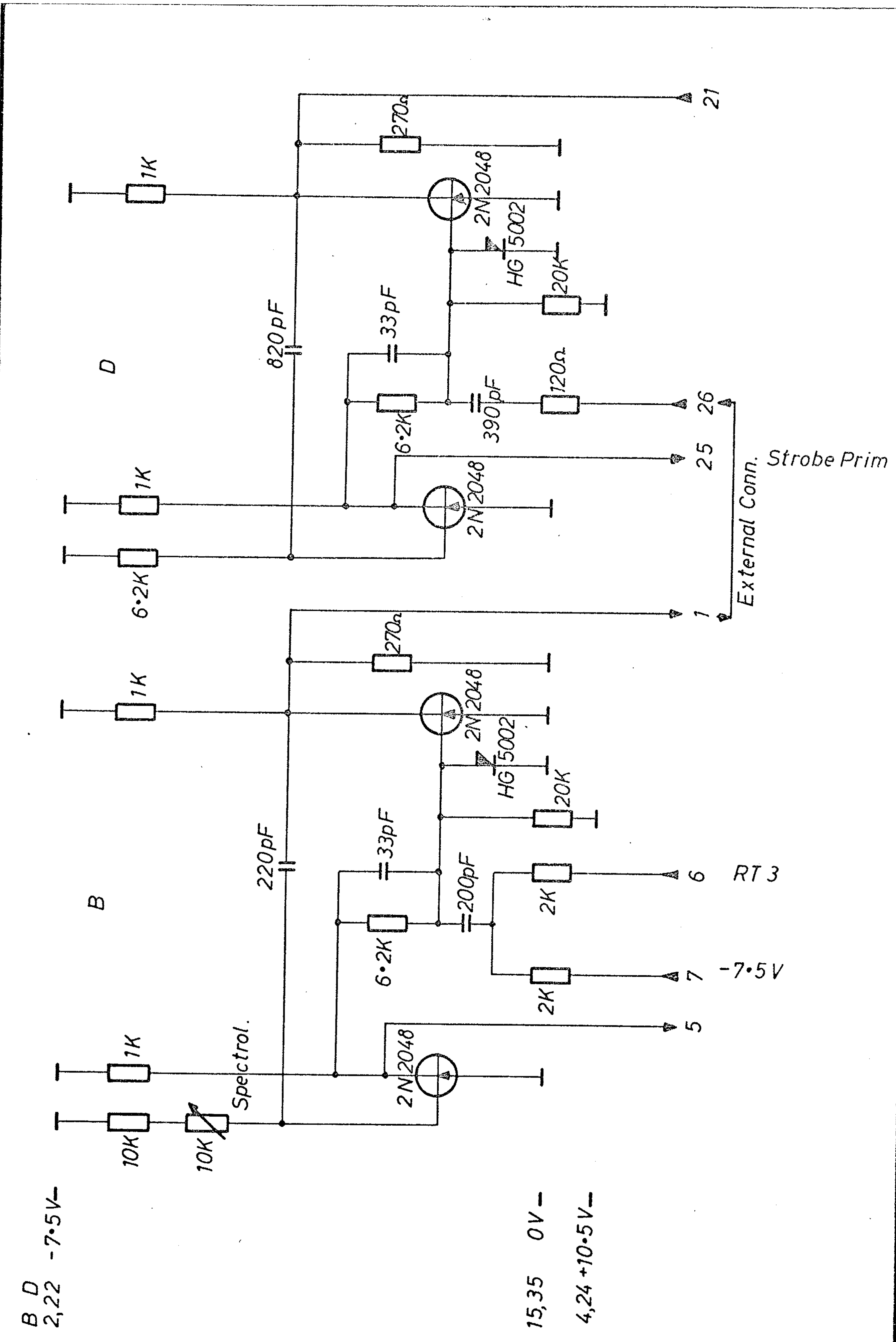
Unit: GIER 6	Designed H. I.	STROBE-SELECTOR	Drawing No
	Approved		Drawn by B. R. 5. 10. 66
REGNE CENTRALEN	Checked 1. 2. 62.		Checked F. E. 22-2-67
	Last Revision		1 Sheets — Sheet 1
			A1-14-15 — 1022



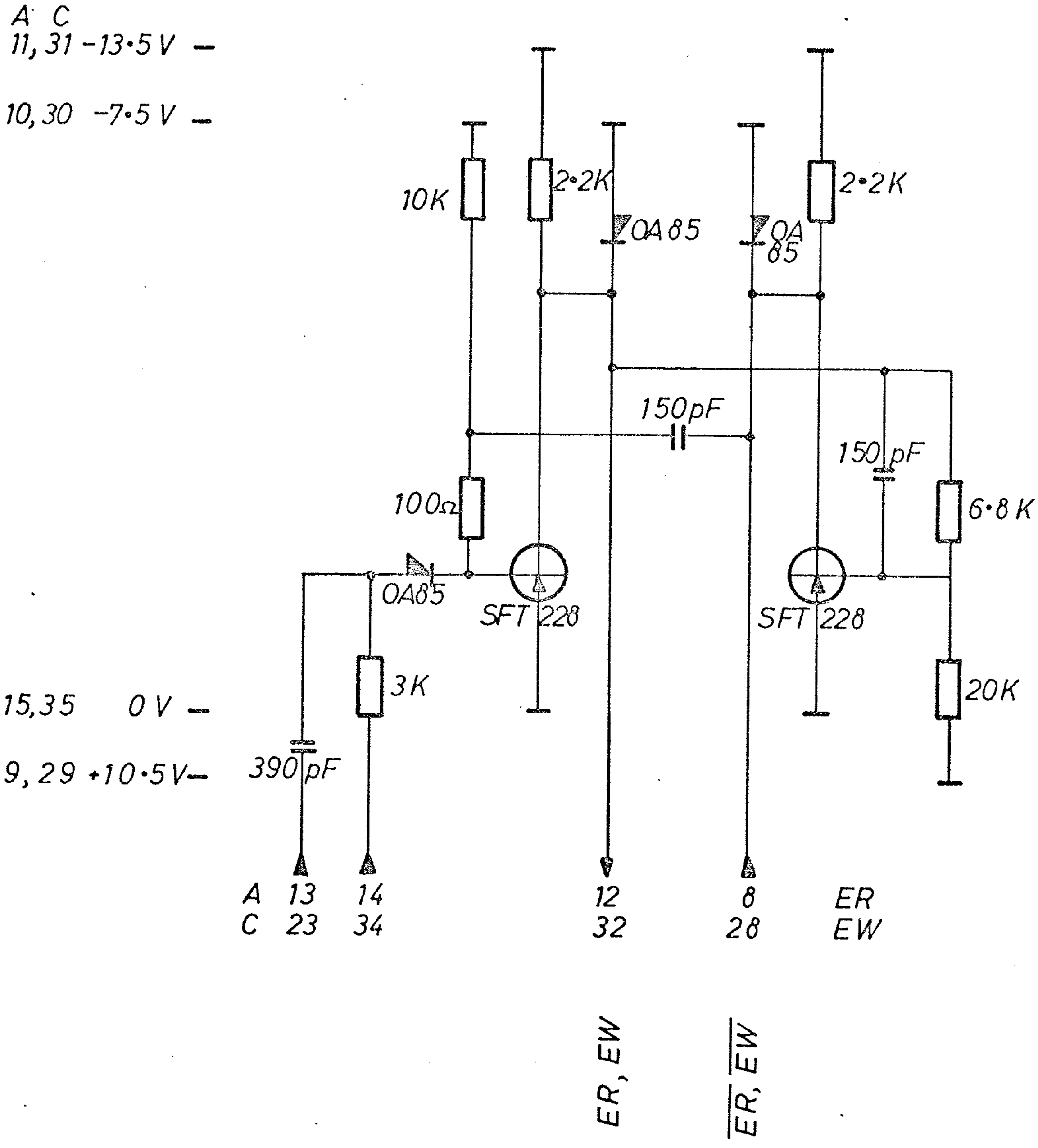
Unit: GIER 6	Designed H. I.	DELAY	Drawing No
REGNE CENTRALEN	Approved		Drawn by G. T. 29.9.66
	Checked 1. 2. 62.		Checked F.E. 22-2-67
	Last Revision		1 Sheets / Sheet 1
			A1-16 / 1006A-15



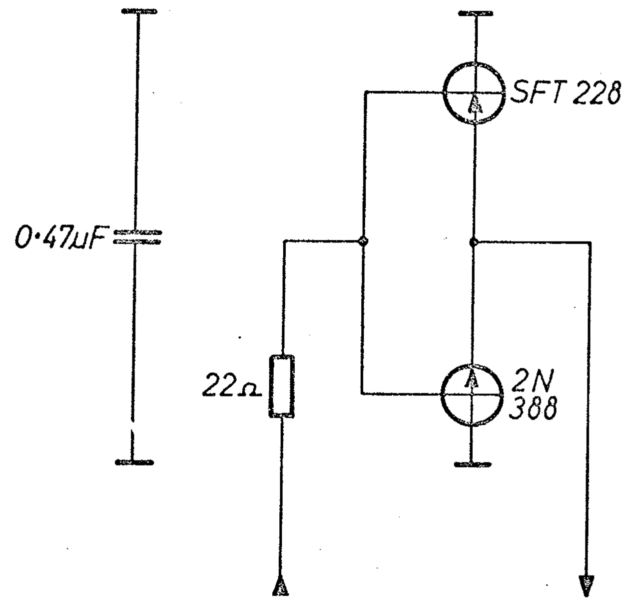
Unit: GIER 6	Designed H. I.	CS TIMING FL. FL.	Drawing No
REGNE CENTRALEN	Approved		Drawn by G. T. 25.7.66
	Checked 1. 2. 62.		Checked F.E 22-2-67
	Last Revision		1 Sheets / Sheet 1
			B1-31-32 / 1006A-14



Unit: GIER 6	Designed H. I.	STROBE DELAY + STROBE PRIM.	Drawing No
REGNE CENTRALEN	Approved		Drawn by B. R. 7. 10. 66
	Checked 1. 2. 62.		Checked F. E.
	Last Revision		2 Sheets / Sheet 1
			B1 – 33 / 1021



Unit GIER 6	Designed H. I.	END READ + END WRITE	Drawing No
REGNECENTRALEN	Approved		Drawn by B. R. 7. 10. 66
	Checked 1. 2. 62.		Checked F. E.
	Last Revision		2 Sheets — Sheet 2
			B1-33 — 1021

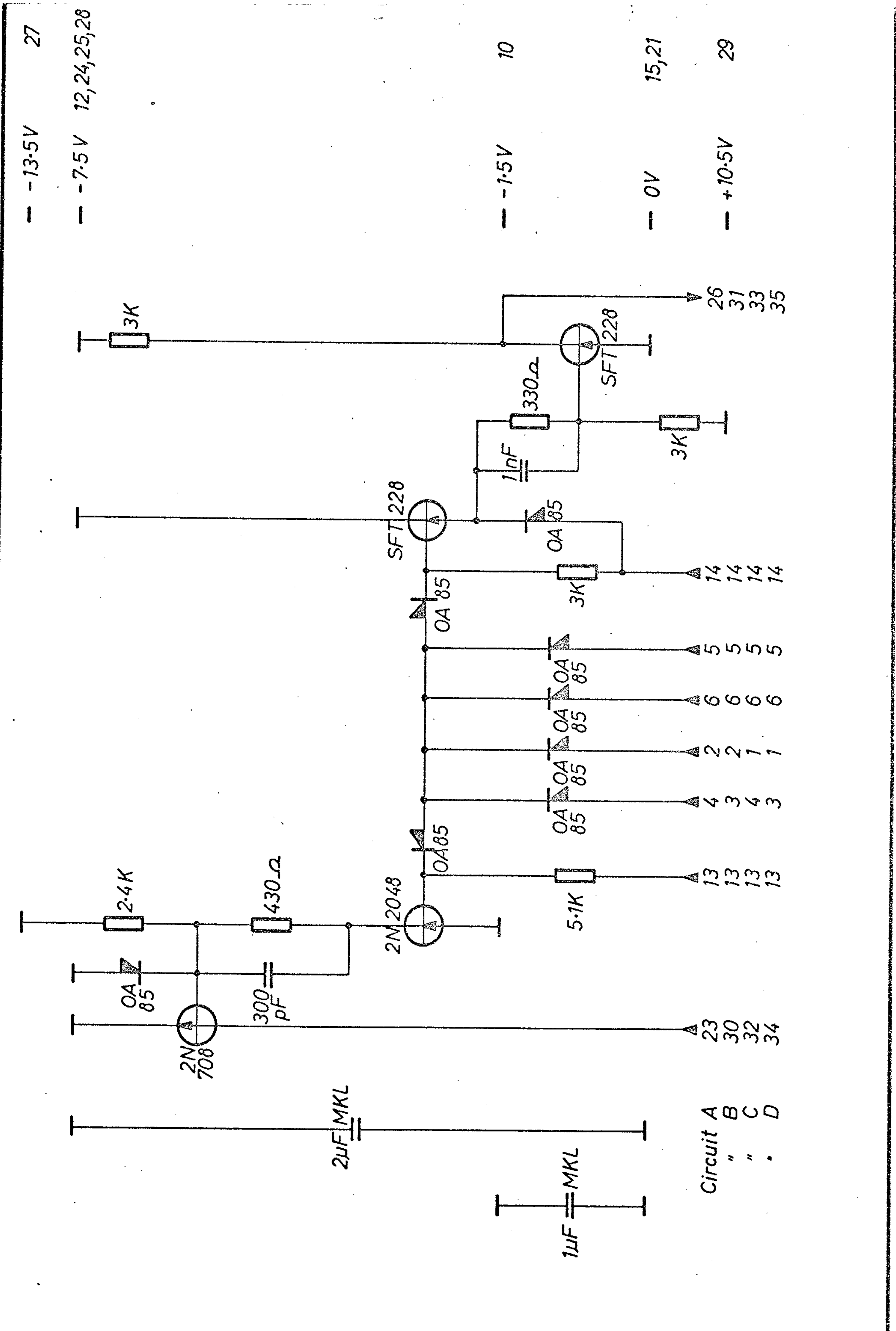


— -7·5V 14,22

— 0V 15,21,32

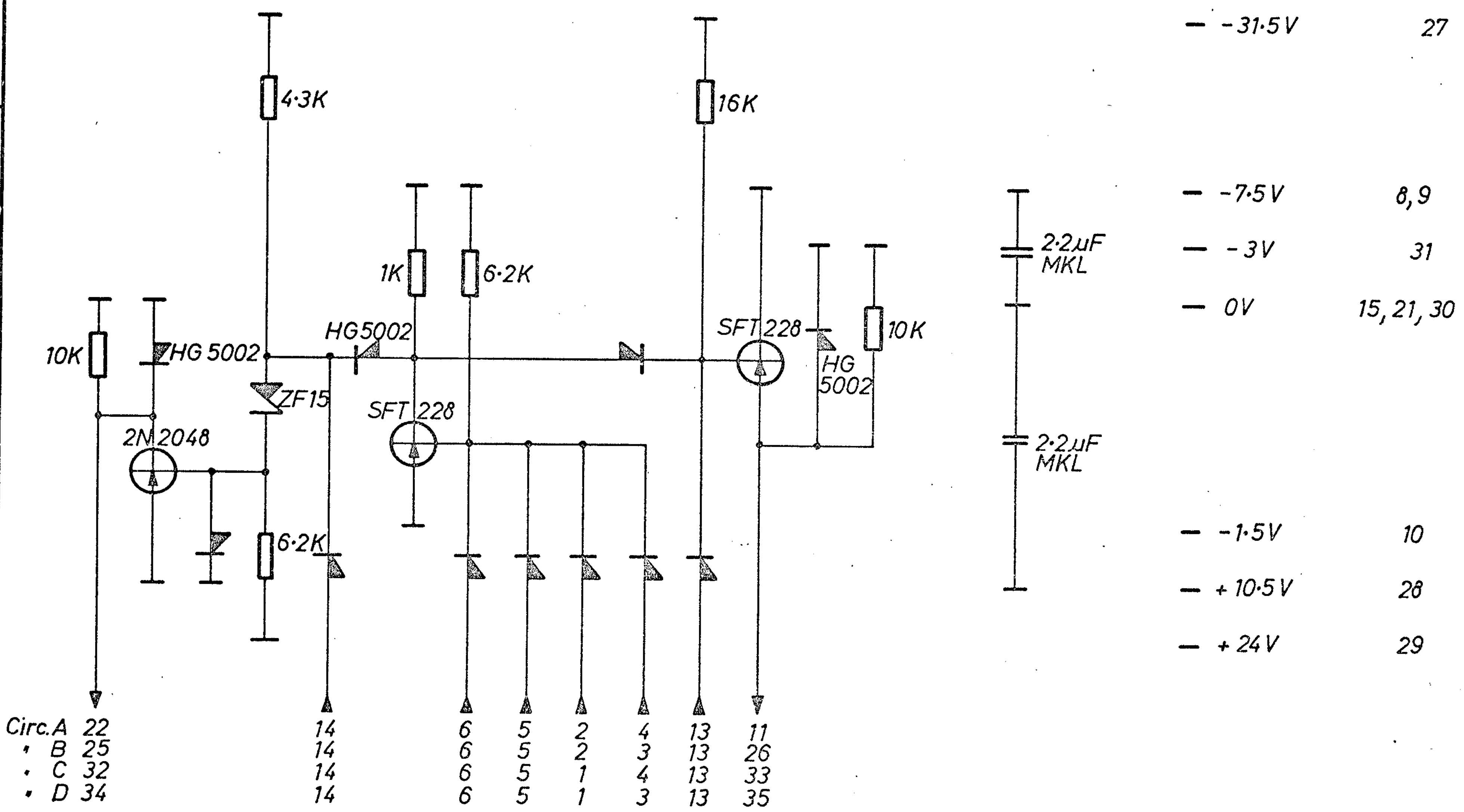
Circuit	A	11	12
"	B	9	10
"	C	7	8
"	D	5	6
"	E	3	4
"	F	1	2
"	G	23	24
"	H	25	26
"	I	27	28
"	J	29	30
"	K	31	33
"	L	34	35

Unit GIER 6	Designed H. I.	AMPLIFIERS	Drawing No
REGNECENTRALEN	Approved		Drawn by G.T. 30.6.66
	Checked 1. 2. 62.		Checked F.E 22-2-67
	Last Revision		1 Sheets / Sheet 1
			B1-34 / 1020

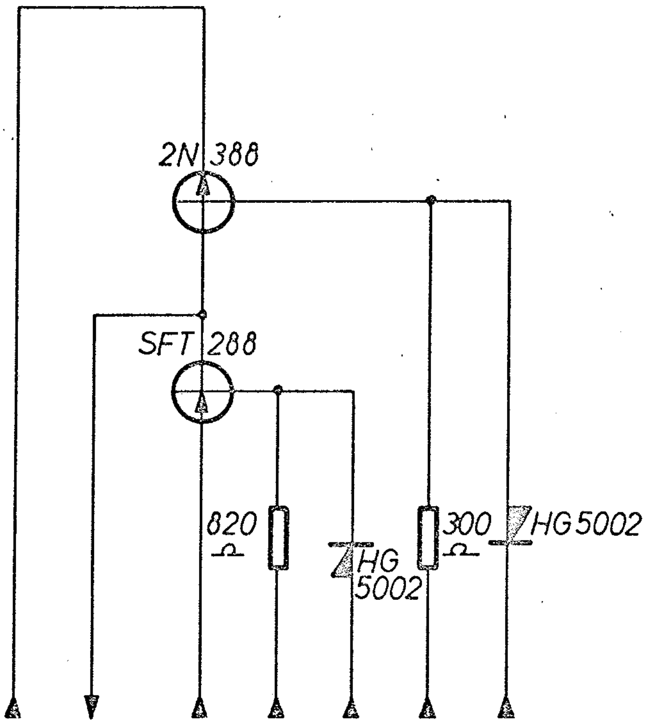


Unit: GIER 6	Designed H. L		Drawing No
REGNECENTRALEN	Approved	$\overline{WB}$ + RB	Drawn by G.T. 4.7.66
	Checked 1. 2. 62.		Checked F.E. 22-2-67
	Last Revision		1 Sheets / Sheet 1
			B1-35-36 / 1002-1

Unmarked Diodes: OA 85

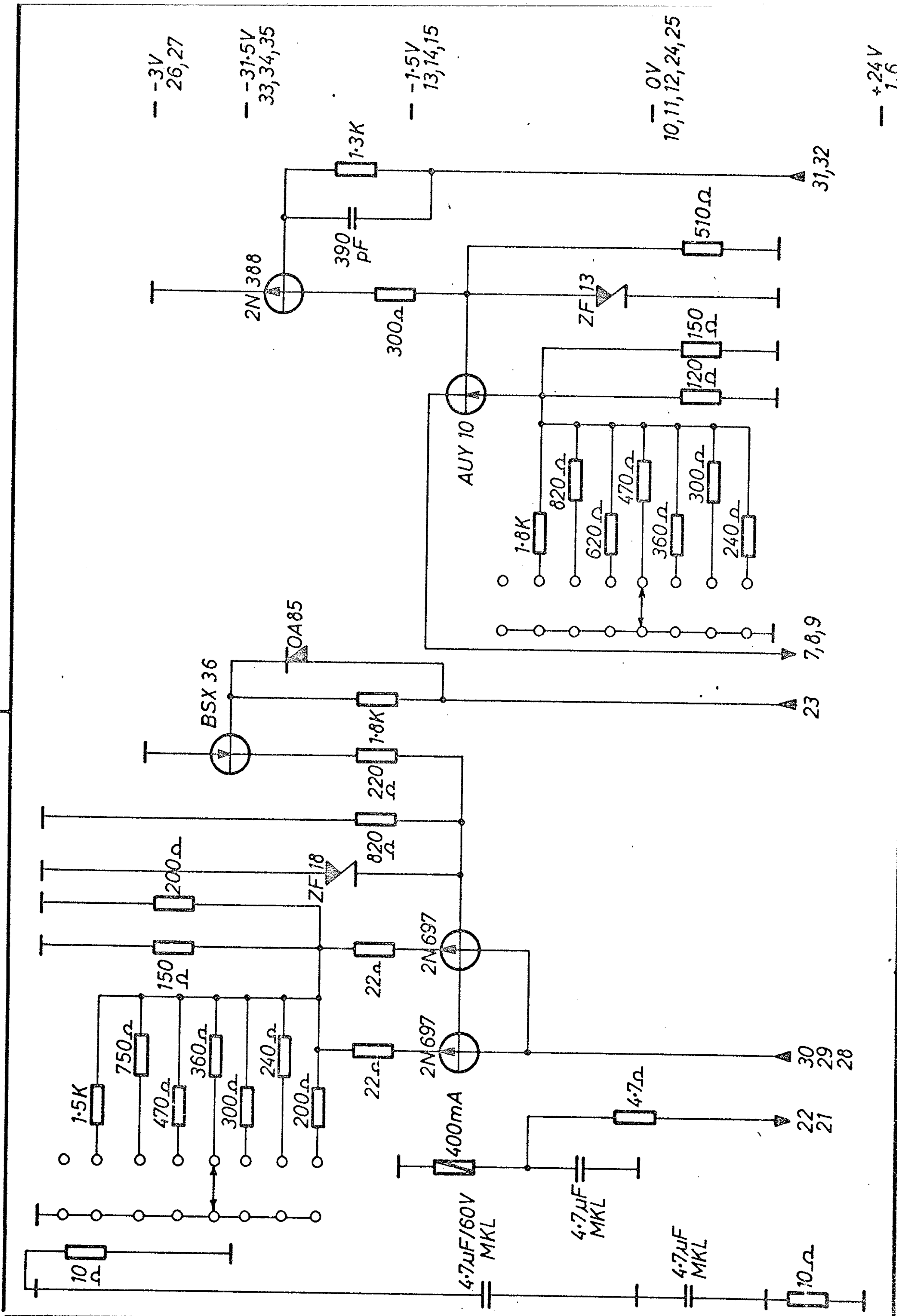


Unit: GIER 6	Designed H. I.	$\overline{WA}$ + RA	Drawing No
REGNECENTRALEN	Approved		Drawn by G.T. 4.7.66
	Checked 1. 2.62.		Checked F.E. 22-2-67
	Last Revision		1 Sheets / Sheet 1
			B1-37-40 / 1003-1

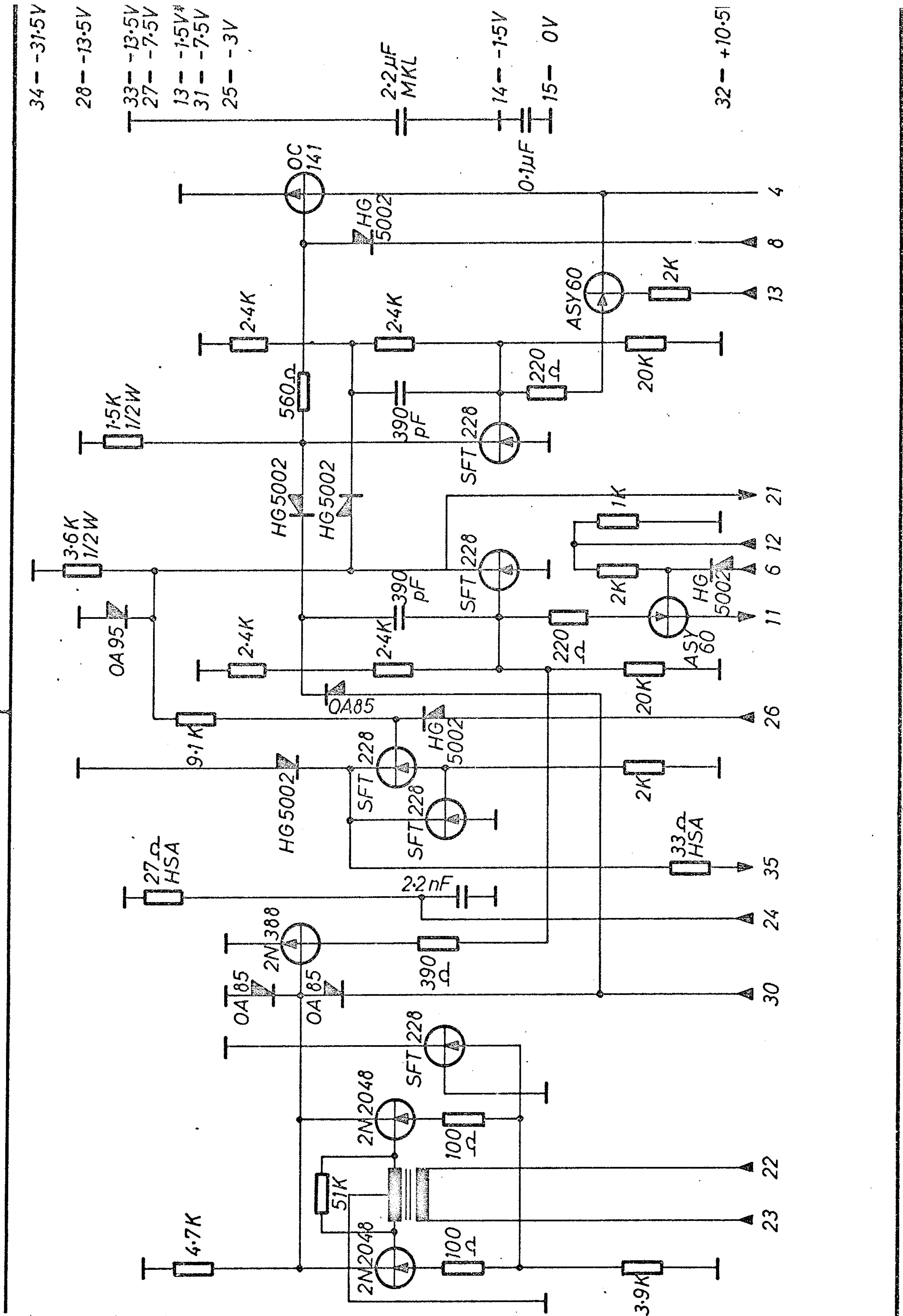


Circuit	I-Write	Out	I-Read	RB	RA	WB	WA
Circuit A:	10,11	35	12,13	14	27	9	1
" B:	"	34	"	"	26	"	2
" C:	"	33	"	"	25	"	3
" D:	"	32	"	"	24	"	4
" E:	"	31	"	"	23	"	5
" F:	"	30	"	"	22	"	6
" G:	"	29	"	"	21	"	7
" H:	"	28	"	"	15	"	8

Unit: GIER 6	Designed H. I.	MATRIX DRIVER	Drawing No
REGNE CENTRALEN	Approved		Drawn by G.T. 25.7.66
	Checked 1. 2. 62.		Checked F.E 28-2-67
	Last Revision		1 Sheets / Sheet 1
			B1-41-48 / 1001-1



Unit GIER 6	Designed H. I.	READ WRITE CURRENT	Drawing No
REGNE CENTRALEN	Approved		Drawn by G.T. 1. 7. 66
	Checked 17-4-68 WJ		Checked F.E 23-2-67
	Last Revision 28.12.69		1 Sheets · Sheet 1
			B1-49-50 · 1232



Unit: GIER 6	Designed H.I.	CS READ AMPLIFIER + BUFFER + INH	Drawing No
REGNE CENTRALEN	Approved		Drawn by G.T. 25.7.66
	Checked 1.2.62.		Checked F.E. 23-2-67
	Last Revision		2 Sheets — Sheet 1
			B2-49-50 — 1024-1

6. Drumstore.

Main principles of control.

Transfer of information between the drumstore and the core store is divided up in a drum-synchronous serialtransfer between the drum and the buffer-register TI and a GIER-synchronous paralleltransfer between TI and the core store. The drumsynchronous transfer is performed by the drumcircuits simultaneous with the execution of instructions not concerning the drum. The corestorageadress to or from which the drumtransfer shall be done, is also calculated by the drumcircuits simultaneous with normal operations. At the moment when the drumcircuits are ready for the parallel transport the execution of simultaneous operations is interrupted for about 26 µS while the paralleltransfer to or from the core store is going on. This is done by a special microprogram which is activated by means of a special set of 8 microaddresses, MAB 1-8, and a special clockpulse, KPB. The time-interval between the 4o interruptions during a channel transfer is about 5oo µS.

Channel selection.

Selection of the channel to or from which a transfer is wanted is done by execution of the operation VK by which the channel number modulo 512 is transferred to the register TK. Any channel-transferoperation is normally executed on condition that an existing channel has been selected. If a transfer to a nonexisting channel is executed (no. 32o-511 or 832 - 1o23) the drumcircuits will be occupied the normal time (about 21 ms). After this the situation is unchanged in the store. If a transfer from a nonexisting channel is executed the corresponding cells in the core-store will be set to zero and the computer will not finish the LK-operation untill the pushbutton "annul. of the TR-paritet" is activated.

The 32o channels in the drumstore are mechanically represented by 32o read-writeheads, which are individually wired to 4o plugs (A2-A11, B2-B11, C2-C11 and D2-D11), but electrically they are separated in 2o groups each containing 16 channels. The read-write heads are decoded from the TK-register. Bits 1-5 (numbers according to the buswire no.) are decoded to an X-value: 1 out of 2o possible (12 are not used) and bits 6-9 are decoded to an Y-value: 1 out of 16 possible. These X- and

Y-values are defining the selected track, and this last part of the decoding is performed by means of the diodes placed in the plugs sitting upon the drum. This part of the decoding in only active during the execution of the operations LK or SK.

Changing of the contents of the TK-register during a channel-transfer is impossible due to the signal "block Gm TK" from card 2o5-4.

Locking for writing.

Some of the drumtracks may be locked for writing. The locking can be done in two levels. The first level comprises normally track no. o-31.. This lock is manually operated and is accessible to the user. It is possible to expand this locking to comprise up to 5 groups of 16 tracks by connecting the X-group in the decoding to one of the spare-inputs upon card 2oo-4. For instance a connection between the pins C3-2o-15 and C5-21-12 will expand the lockingarea to tracks o-47.

The second level of locking comprises normally only track no. 0, and is not accessible to the user. Unlocking can be done by removing the short circuit pin upon card 2oo-4. This locking may also be expanded so that it comprises up to 16 tracks, no. o-15, by connecting the appropriate Y-group in the decoding to C3-24-1N.

The execution of an SK-instruction where the selected track has been locked will be finished without writing during 9 µsec. for the basic-operation plus the normal executiontime for the modifications.

Clocktracks.

The drum is equipped with 3 clocktracks and associated readamplifiers. Clocktrack no. I contains one mark for detecting word no. 0, track no. II a marking for each of the 4o words, and track III a marking for each bit in all words.

Transfers to and from the drum.

The microprograms for the druminstructions LK and SK begin with the microoperation "Gm sæt TL" which will read the value of the signal TR" into the flip-flop TL upon card no. 266. If TL becomes 1 it means that the drumcircuits are unoccupied (TL means "Tromle ledig" or "drum ready"), and the microprogram will proceed with starting the drumcircuits by means of the microoperation "Gm start TR", which will set one of the flip-flops upon the card 264 dependent on whether it is a write-or a read-operation. This flip-flop will remain set during the drumacces and will select the correct microprogram to be executed at the interruptions when words are transferred to or from the core store. The syncronizing signal to the start-stop circuits SL ("skriv-læs" means ready for write to or read from core memory)is derived from this flip-flop and clockpulse II. The delay of 12 µsec. upon card 261 is nescessary due to the parity check (see later).

As the drum acces is initiated non-syncronous to the drum, the serial transfer of information from the drum to the TI-register may start in the middle of a word, so that the first word transferred to the corestore is not correct. The drumacces is therefore always transferring 41 words so that the first word in the acces is beeing transferred 2 times where the last one is always correct. The counting of the number of words transferred is done by means of the counting register TKT. This register is cleared (set to zero) at the beginning of a drumaccess (and when a parityfault occurs in a word). When the contents of TKT is 41, the drumacces is finished by resetting the flip-flop upon the card 264.

If a SK-instruction is initiated during the word-time of word no. 39, the 41'st counting pulse to TKT will finish the drumaccess just before the second and correct writing of word no. 39 occurs. To prevent this, an extra clearing of TKT is being executed just before word no. 0 is written the first time in the above mentioned situation.

Addresscalculation.

The resultant address of a LK or SK-instruction is transferred to the TBA-register. The TOT-register always contains the word no. of the word thas has just passed the read/writehead. The sum of TBA and TOT is calculated by means of the drumadder. This number is the corememoryaddress to where the word from the drum shall be transferred at the storing-interruption during execution of a LK-instruction. In c ase of the SK-instruction this sum from the drumadder has to be increased by one to give the address in the corememory wherefrom to fetch the word that shall be written upon the drum. This is done by setting the carryinput of the lowest position of the adder to the value 1. When word no. 0 is to be transferred the contents of TOT must be -1 this value is set into TOT during wordtime 39.

The contents of register TBA cannot be seen from the display in the operators panel, but by means of a DM 16o lampcard placed in A1-23.

During the B-microprograms which executes the transfers between the corestore and the drumstore the output from the drumadder is transferred to the TA-register and the inputs to the addressdecoding of the core store are connected to TA instead of AD1. This shift of them decoding is done by means of a flip-flop upon the card 266.

Wordtransfer.

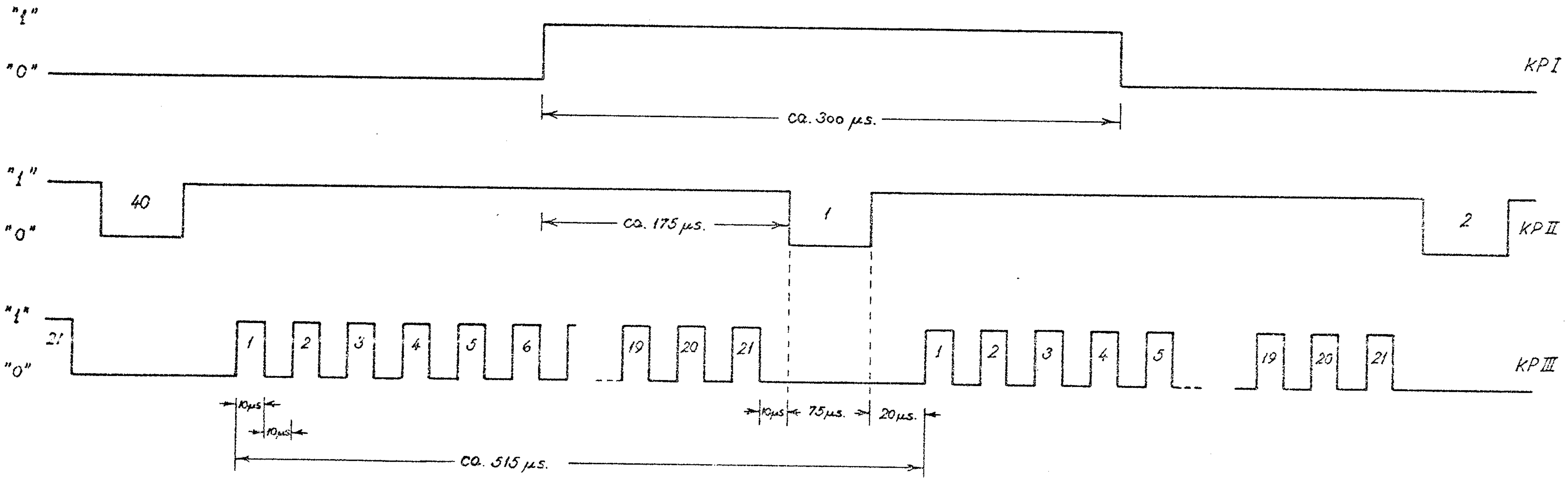
The serialtransfer between the drum and the bufferregister TI is performed one bit at a time, the contents of TI beeing shifted one position to the left for every bittime. During writing upon the drum the signal for controlling the write amplifier is taken from TI-position 0 while during reading the output from the readamplifier is connected to TI-position 41. The shiftpulse for TI is derived from clockpulse III and II, the shifts being performed at the times where the value of clockpulse III is changing from 1 to 0 and from 0 to 1 and where clockpulse II changes from 1 to 0. The principle of writing that is used is called NRZ, non-return-to-zero, because the current in the writehead is always running one or the other way. It is shifting at the beginning of words, at every bit = 1 in the words and after the finish of a word if the number of 1's was even.

The signal from the read amplifier is setting a flip-flop which again steers another flip-flop strobed by a signal derived from the clock-pulses. After this the shifting begins in a flip-flop called TI-pos.42. The last bit that is read in a word-time is the paritybit, which remains in TI-pos. 42 during the succeeding paralleltransfer to the corestore. At the shifting-in into TI of the next word from the drum, the proceeding word is shifted out through TI-0 and is lost.

Paritycontrol.

The paritycheck at reading claims that every word including paritybit contains an odd number of ones. The "ones"are counted by means of a flip-flop upon card 263. At the end of a word-time this flip-flop must contain a 0 indicating correct parity , at the beginning it contains 1. If this is not so the signal SL will via the logik cause a resetting of register TKT and the transfer will start from the beginning. If the fault continues the tracktransfer will never finish, unless the operator cancel the paritycheck by means of the switch "Annul.tr.paritet" (The red lamp will light when the check is inactive). Operating the "Reset"-button will as usual stop every action.

Simultaneously with the resetting of TKT because of parityfault another flip-flop upon the card 263 will be set, and later it will be reset when TKT = 41. This flip-flop will light the lamp at the operatorspanel called "Tromlefejl" indicating error in the drum. Because of the non-syncronous start of reading from the drum, the first word read is often with parityfault. To prevent the lamp from lighting for this reason, there is a delay between the flip-flop and the lamp.



GIER drumcircuits

Clockpulses I, II and III

Operation no 52

Operation LK

MA	Gs	Gm	CS	Decoding	No	Jump
1		set TI,ob+c				
		step				12
12	AD1	TBA				
		start Drum		Drum ready TL	9a	13
12	Dummy			Drum busy TL	9b	1
13	Mode 4					2
1B	AD1	TA				
2B	TR-Add.	AD1				
3B	TI0-41	LI0-41	Write			
4B						
5B	Dummy					
6B						
7B	TA	AD1				
8B	Stop B-pulse	shift B--A				

Unit GIER 6

REGNECENTRALEN

Designed H.I.

Approved

Checked 1.2.62

Last Revision

MICROPROGRAMS

Drawing No

Drawn by L.L.21.2.67

Checked F.E.23-2-67

1 Sheets Sheet 1

Operation no.: 53

Operation. SK

MA	Gs	Gm	C.S.	Decoding	No	Jump
1		set TI, ob+c				
		step				12
12	AD1	TBA		Drum ready TL	9a	13
		Start Drum				
				Drum busy TL	9b	1
12	Dummy					
13	Mode 4					2
1B	AD1	TA				
2B	TR-Add	AD1				
3B			Read 0-41			
4B						
5B			Dummy			
6B	LI0-41	TI0-41				
7B						
8B	Stop B-pulse	shift B--A				
	TA	AD1				

Unit GIER 6

REGNECENTRALEN

Designed H.I.

Approved

Checked 1.2.62

Last Revision

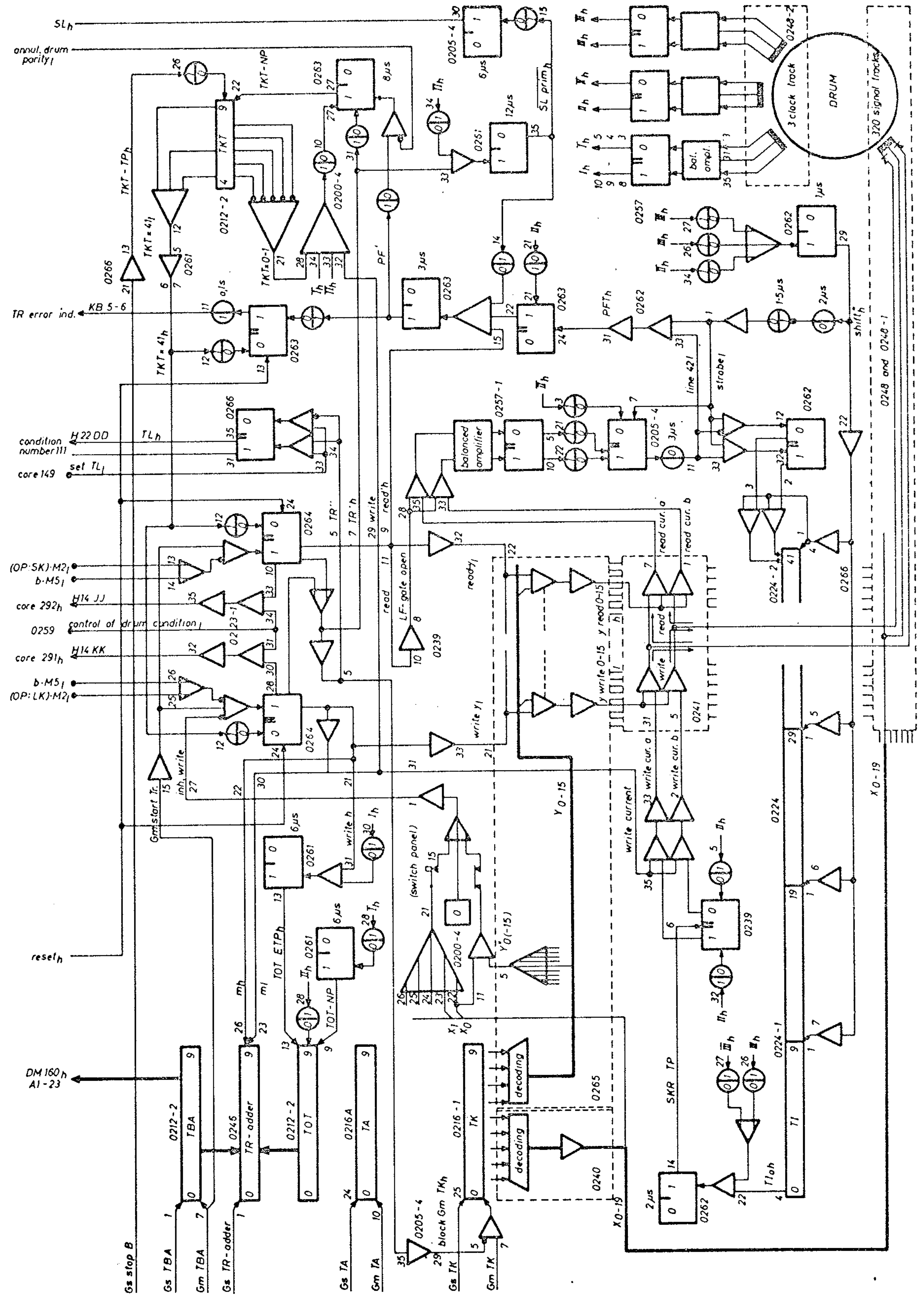
MICROPROGRAMS

Drawing No.

Drawn by L.L. 21.12.60

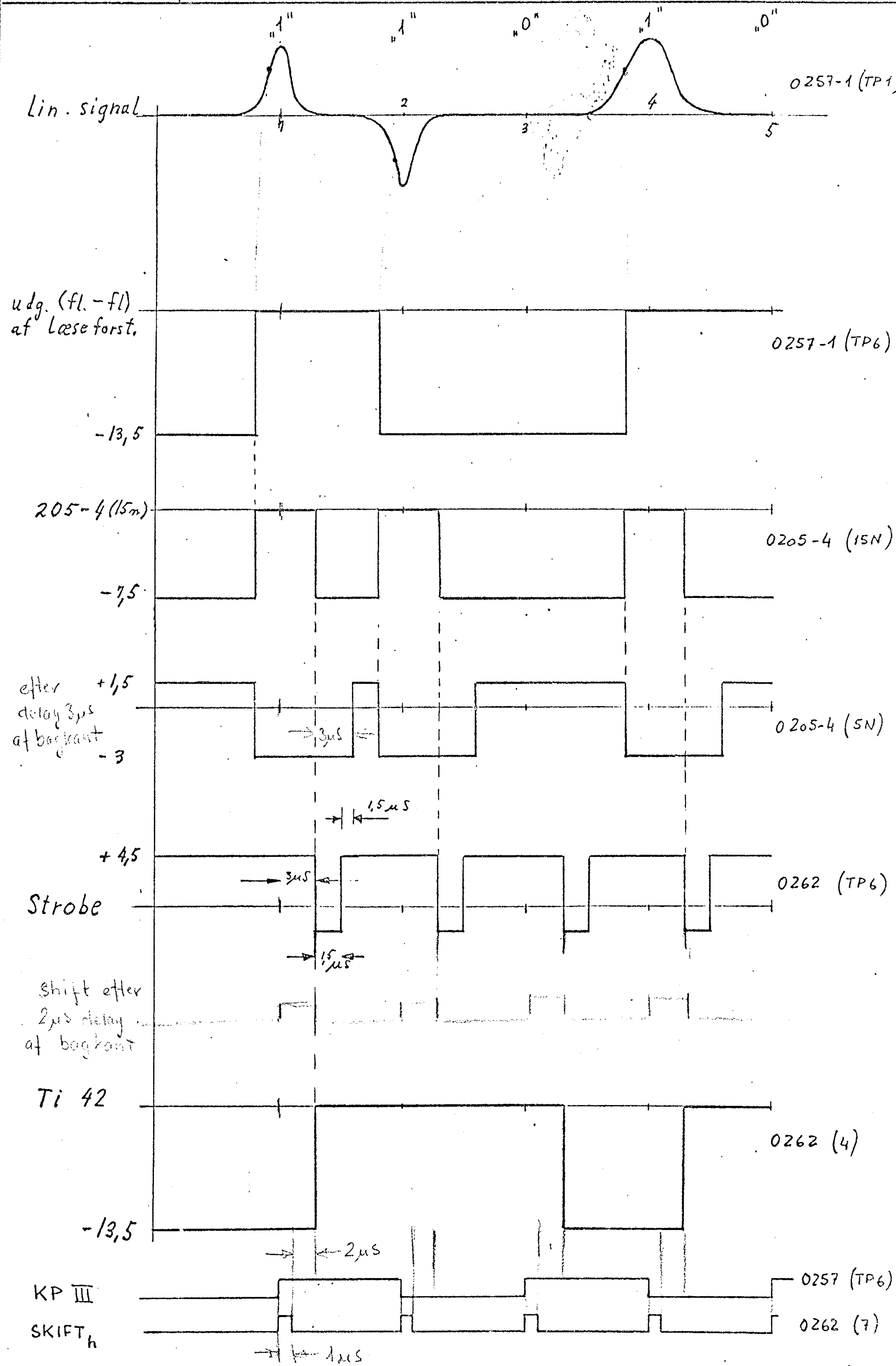
Checked F E 20-2-67

1 Sheets Sheet 1

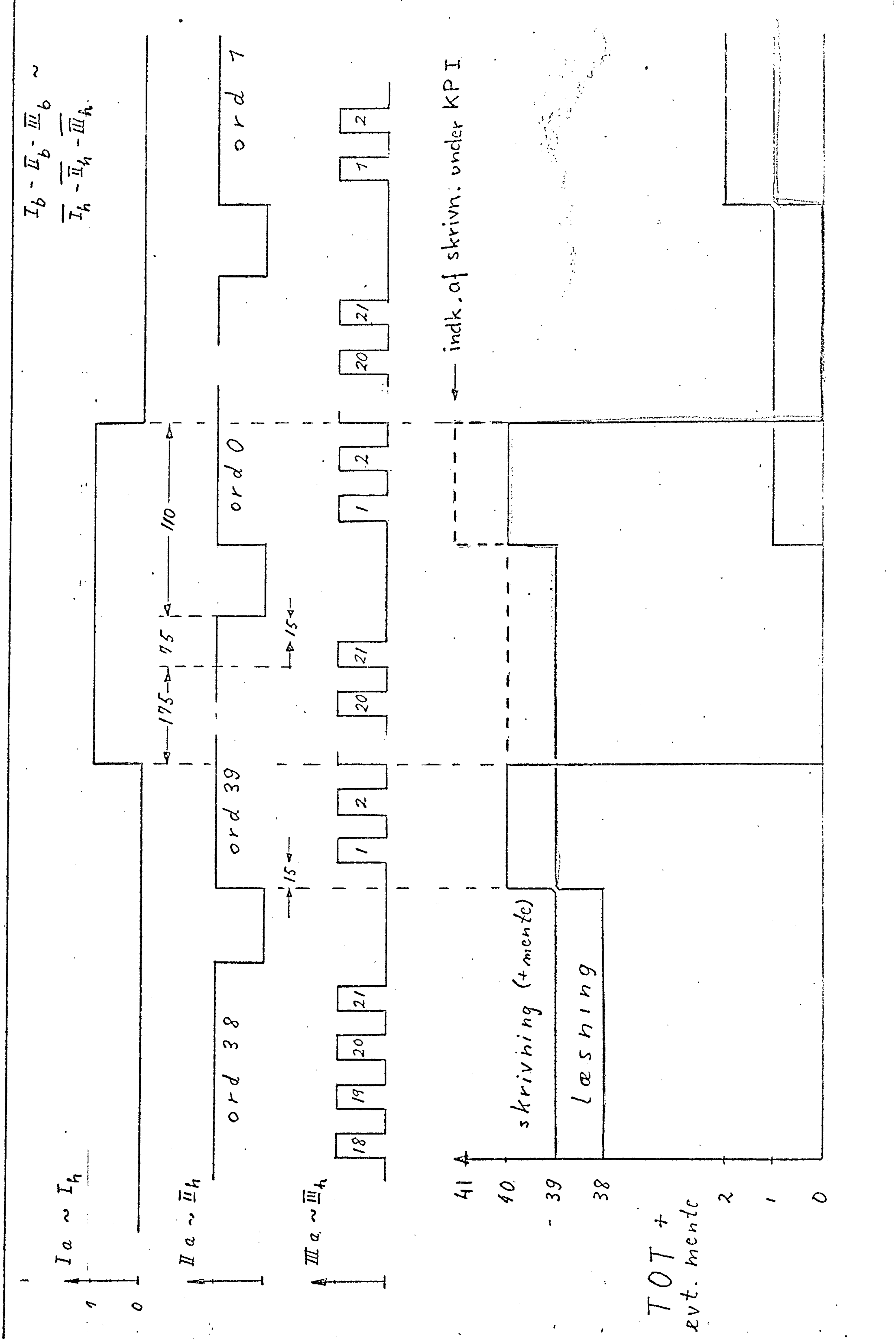


Unit: GIER 6	Designed P.E.P.	BLOCKDIAGRAMS FOR DRUM CIRCUTS	Drawing No
REGNECENTRALEN	Approved		Drawn by G.T. 9.9.66
	Checked 12.12.64.		Checked F.E. 22-8-67
	Last Revision		1 Sheets · Sheet 1

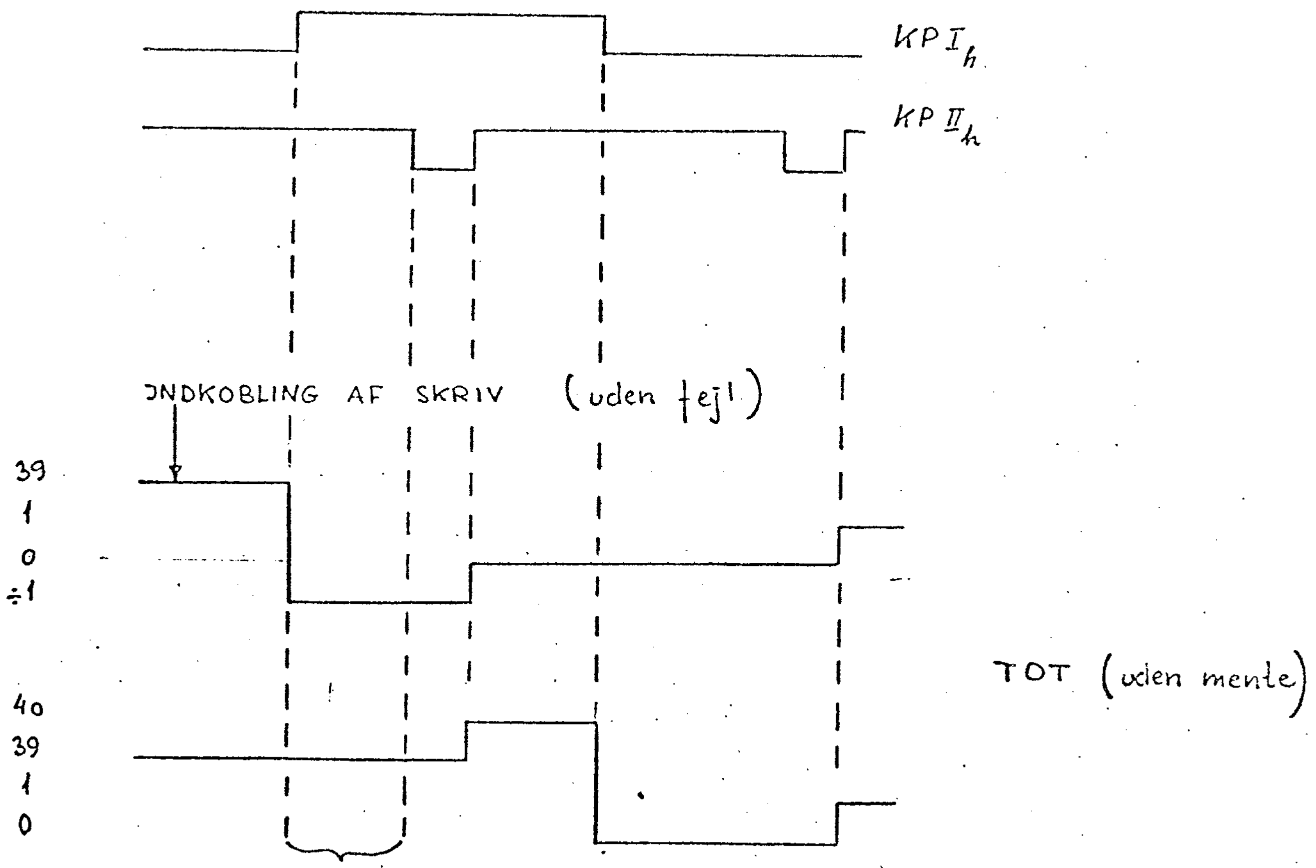
A/S REGNECENTRALEN	Vedrører Emne: Pulser i TR-kredsløb efter PEP	Opg. nr.:	1 19	Sign. EKH



A/S REGNECENTRALEN	Emne: Tidsdiagram for tromle klokimpulser	Opg. nr.:	/ 19	Sign. EKH



Ved skrivning skal transport af et ord foregå før skrivning, i modsætning til læsning hvor transporten foregår efter læsningen. TOT tilføres derfor en mente i sidste pos. under skrivning. For at kunne transportere ord nr. 0 stilles TOT på ÷1 på forkanten af KP I. Hvis indkoblingen sker som vist på tegningen, vil ord nr. 0 ikke blive transporteret, og operationen ville blive afsluttet netop som ord nr. 0 skulle skrives. For at hindre dette nulstilles TKT ved indkobling af skrivning under $KP\,I_h \times KP\,II_h$

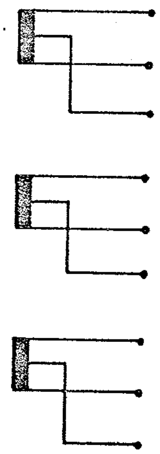


INDKOBLING AF SKRIV (dette område ville medføre den omtalte fejl)

	Column D	Column A	Column B	Column C
1	0248-2			
2	0248	0248	0248	0248
3	0248-1	0248	0248-1	0248
4	0248	0248	0248	0248
5	0248	0248-1	0248	0248-1
6	0248	0248	0248	0248
7	0248	0248	0248	0248
8	0248-1	0248	0248-1	0248
9	0248	0248	0248	0248
10	0248	0248-1	0248	0248-1
11	0248	0248	0248	0248

2 Cards for each plug

The clock pulses are transferred from D1 (or possibly from A1, B1, or C1) via Cards 0248-2, which do not contain Diodes, but are Connected according to the following Diagram.

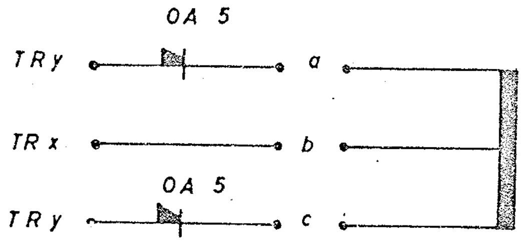


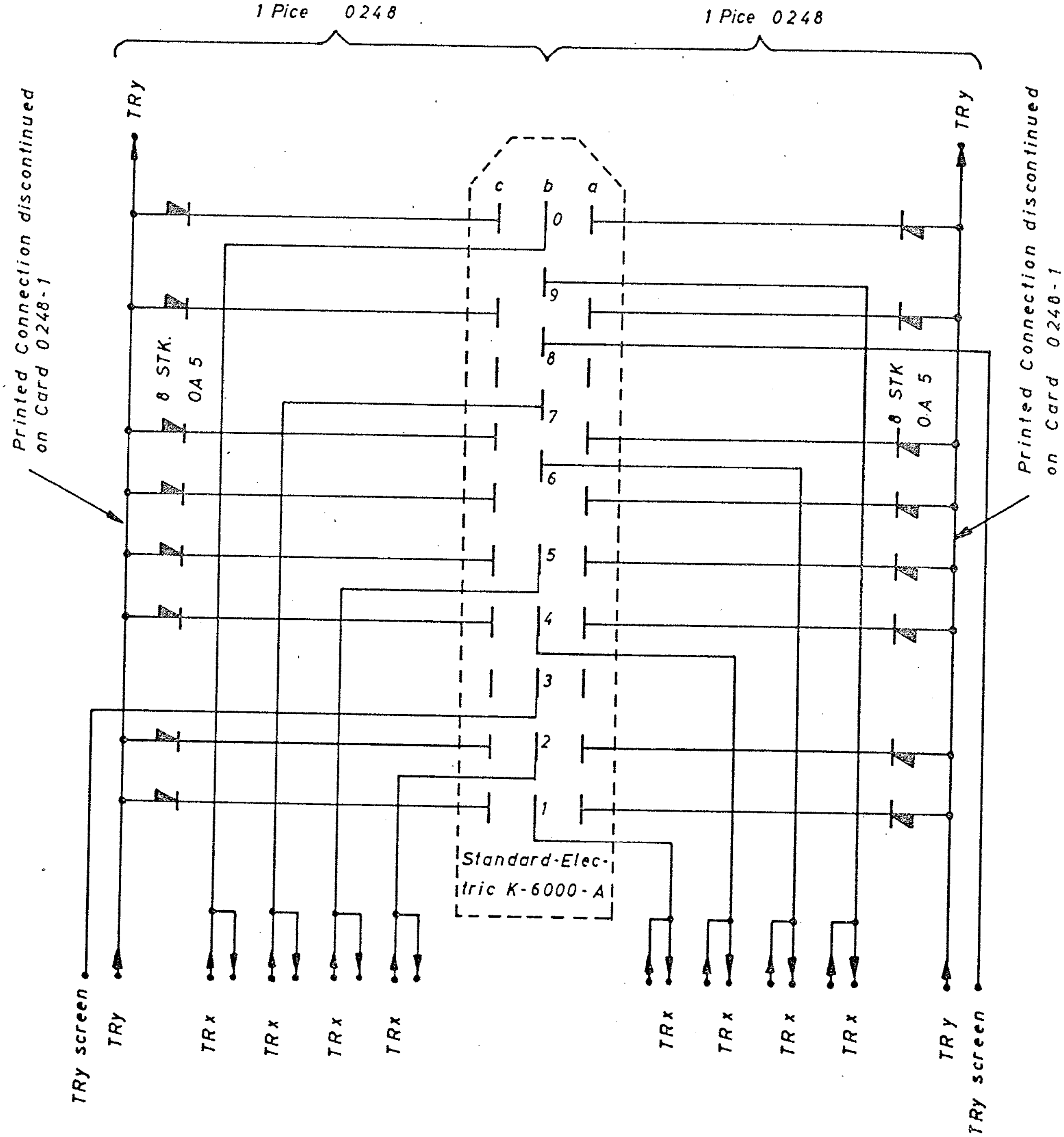
TR	Ia	5b
TR	Ib	2b
TR	I screen	5c
TR	IIa	0b
TR	IIb	7b
TR	II screen	0c
TR	IIIa	1a
TR	IIIb	1c
TR	III screen	1b

Unit: GIER 6	Designed H.I.	Drum Plug Distribution	Drawing No
REGNE CENTRALEN	Approved		Drawn by R.N.2.1.67
	Checked 1.2.62		Checked F.E.25-2-67
	Last Revision		3 Sheets, Sheet 2
			0248-1-2

0248 8 half-circuits per Card

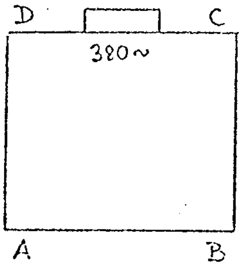
0248-1 2x4 half-circuits per Card

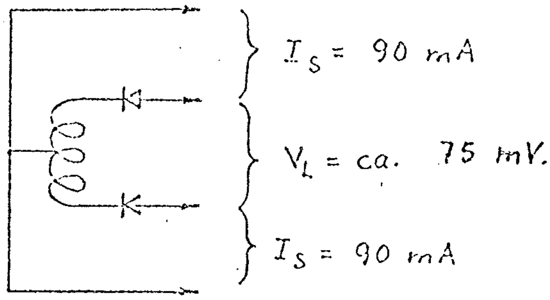


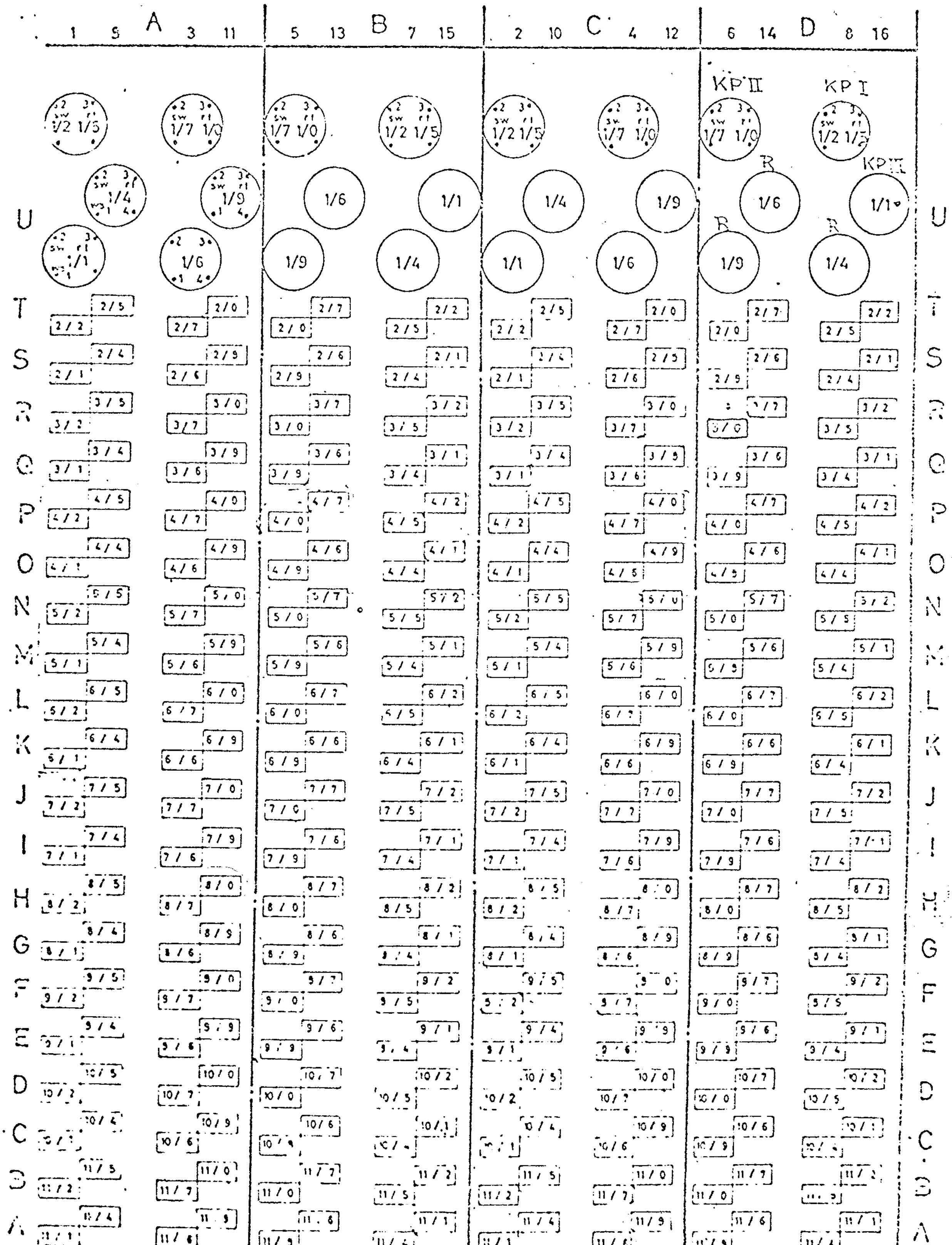


Unit: GIER 6	Designed H. I.	Diodelogik, TR,	Drawing No
REGNECENTRALEN	Approved		Drawn by R. N. 11.1.67.
	Checked 1. 2. 62.		Checked F.E. 23-2-67
	Last Revision		3 Sheets · Sheet 1
			0248

A/S REGNECENTRALEN | Emne: TROMLE | Opg. nr.: | 16/1 19 | Sign. | Side







Associated track numbers and locations: Ex. Track no. 197: (X,Y)== (12.5). Location: Plug D9-5

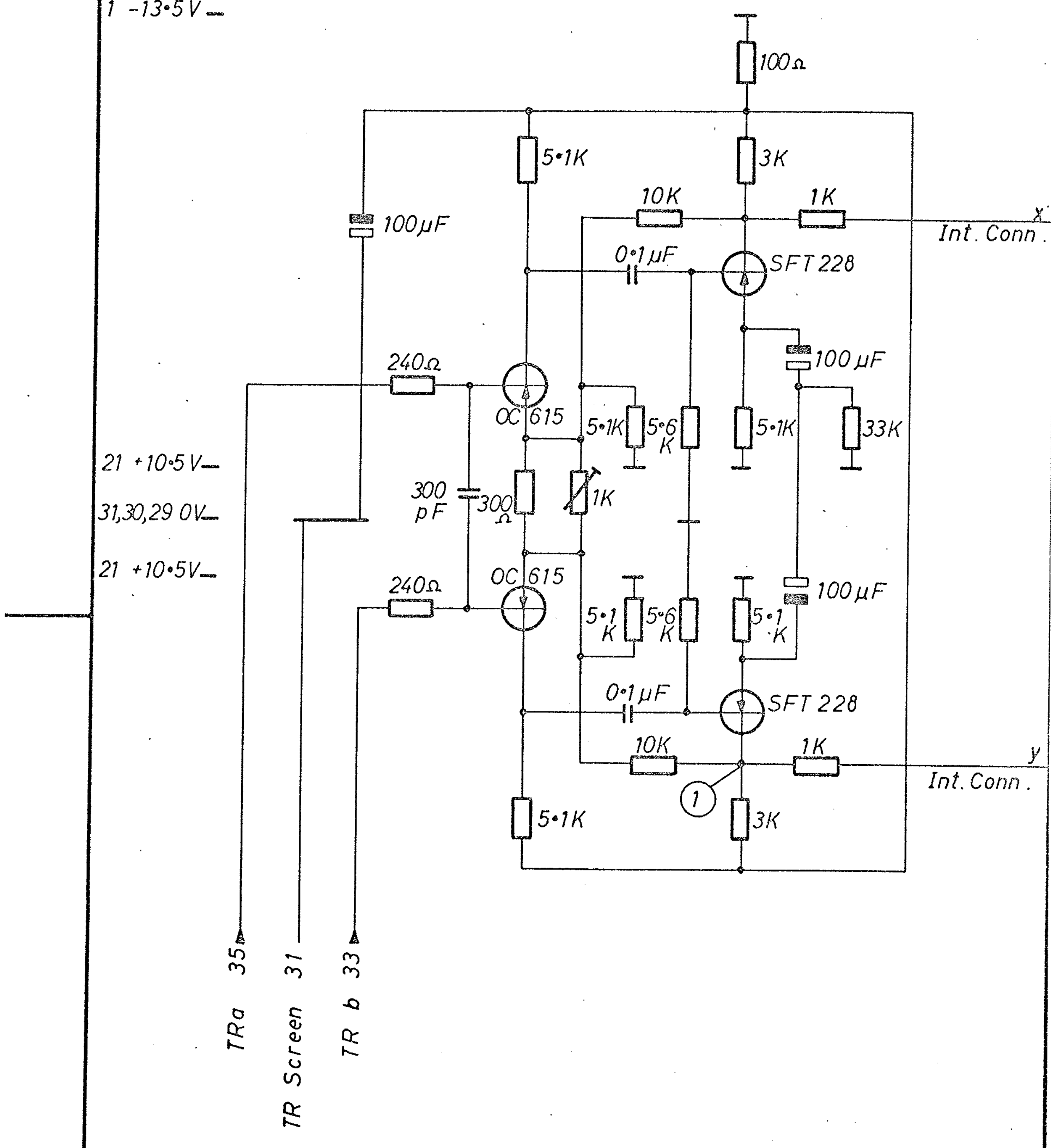
X \ Y	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	A2-0	A3-1	A4-0	A6-1	A7-0	A8-1	A9-0	A11-1	C2-0	C3-1	C4-0	C6-1	C7-0	C8-1	C9-0	C11-1
1	A2-9	A3-2	A4-9	A6-2	A7-9	A8-2	A9-9	A11-2	C2-9	C3-2	C4-9	C6-2	C7-9	C8-2	C9-9	C11-2
2	A2-7	A3-4	A4-7	A6-4	A7-7	A8-4	A9-7	A11-4	C2-7	C3-4	C4-7	C6-4	C7-7	C8-4	C9-7	C11-4
3	A2-6	A3-5	A4-6	A6-5	A7-6	A8-5	A9-6	A11-5	C2-6	C3-5	C4-6	C6-5	C7-6	C8-5	C9-6	C11-5
4	A2-5	A3-6	A4-5	A6-6	A7-5	A8-6	A9-5	A11-6	C2-5	C3-6	C4-5	C6-6	C7-5	C8-6	C9-5	C11-6
5	A2-4	A3-7	A4-4	A6-7	A7-4	A8-7	A9-4	A11-7	C2-4	C3-7	C4-4	C6-7	C7-4	C8-7	C9-4	C11-7
6	A2-2	A3-9	A4-2	A6-9	A7-2	A8-9	A9-2	A11-9	C2-2	C3-9	C4-2	C6-9	C7-2	C8-9	C9-2	C11-9
7	A2-1	A3-0	A4-1	A6-0	A7-1	A8-0	A9-1	A11-0	C2-1	C3-0	C4-1	C6-0	C7-1	C8-0	C9-1	C11-0
8	D2-1	D4-0	D5-1	D6-0	D7-1	D9-0	D10-1	D11-0	B2-1	B4-0	B5-1	B6-0	B7-1	B9-0	B10-1	B11-0
9	D2-2	D4-9	D5-2	D6-9	D7-2	D9-9	D10-2	D11-9	B2-2	B4-9	B5-2	B6-9	B7-2	B9-9	B10-2	B11-9
10	D2-4	D4-7	D5-4	D6-7	D7-4	D9-7	D10-4	D11-7	B2-4	B4-7	B5-4	B6-7	B7-4	B9-7	B10-4	B11-7
11	D2-5	D4-6	D5-5	D6-6	D7-5	D9-6	D10-5	D11-6	B2-5	B4-6	B5-5	B6-6	B7-5	B9-6	B10-5	B11-6
12	D2-6	D4-5	D5-6	D6-5	D7-6	D9-5	D10-6	D11-5	B2-6	B4-5	B5-6	B6-5	B7-6	B9-5	B10-6	B11-5
13	D2-7	D4-4	D5-7	D6-4	D7-7	D9-4	D10-7	D11-4	B2-7	B4-4	B5-7	B6-4	B7-7	B9-4	B10-7	B11-4
14	D2-9	D4-2	D5-9	D6-2	D7-9	D9-2	D10-9	D11-2	B2-9	B4-2	B5-9	B6-2	B7-9	B9-2	B10-9	B11-2
15	D2-0	D4-1	D5-0	D6-1	D7-0	D9-1	D10-0	D11-1	B2-0	B4-1	B5-0	B6-1	B7-0	B9-1	B10-0	B11-1
16	D3-0	D3-5	A5-1	A5-6	D8-0	D8-5	A10-1	A10-6	B3-0	B3-5	C5-1	C5-6	B8-0	B8-5	C10-1	C10-6
17	D3-9	D3-4	A5-2	A5-7	D8-9	D8-4	A10-2	A10-7	B3-9	B3-4	C5-2	C5-7	B8-9	B8-4	C10-2	C10-7
18	D3-7	D3-2	A5-4	A5-9	D8-7	D8-2	A10-4	A10-9	B3-7	B3-2	C5-4	C5-9	B8-7	B8-2	C10-4	C10-9
19	D3-6	D3-1	A5-5	A5-0	D8-6	D8-1	A10-5	A10-0	B3-6	B3-1	C5-5	C5-0	B8-6	B8-1	C10-5	C10-0

Drum Tracks 0-319 are represented by bit 1-9, which are decoded in x (bit 1-5), and y (bit 6-9).

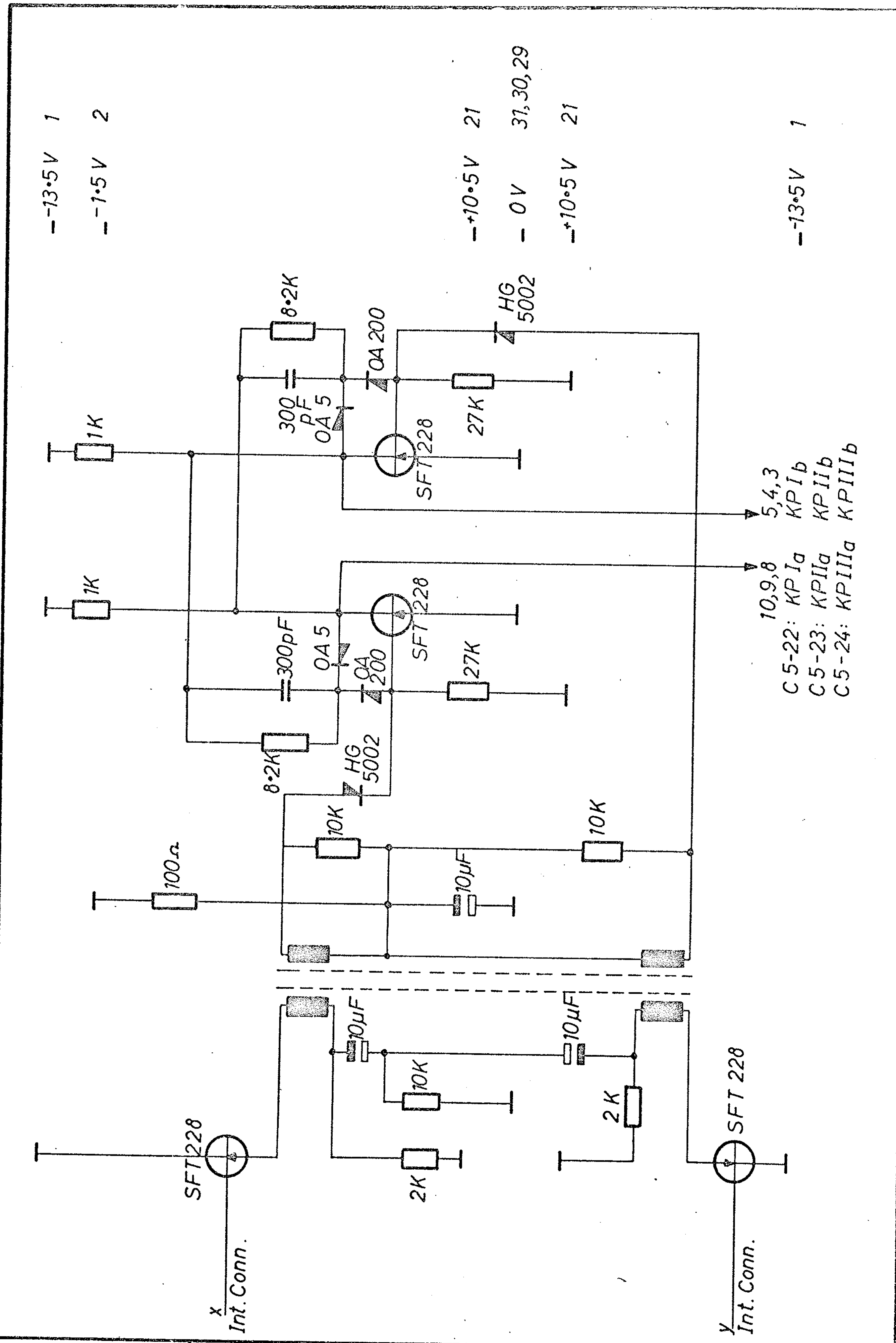
TK: 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

X (bits 1-5) Y (bits 6-9)

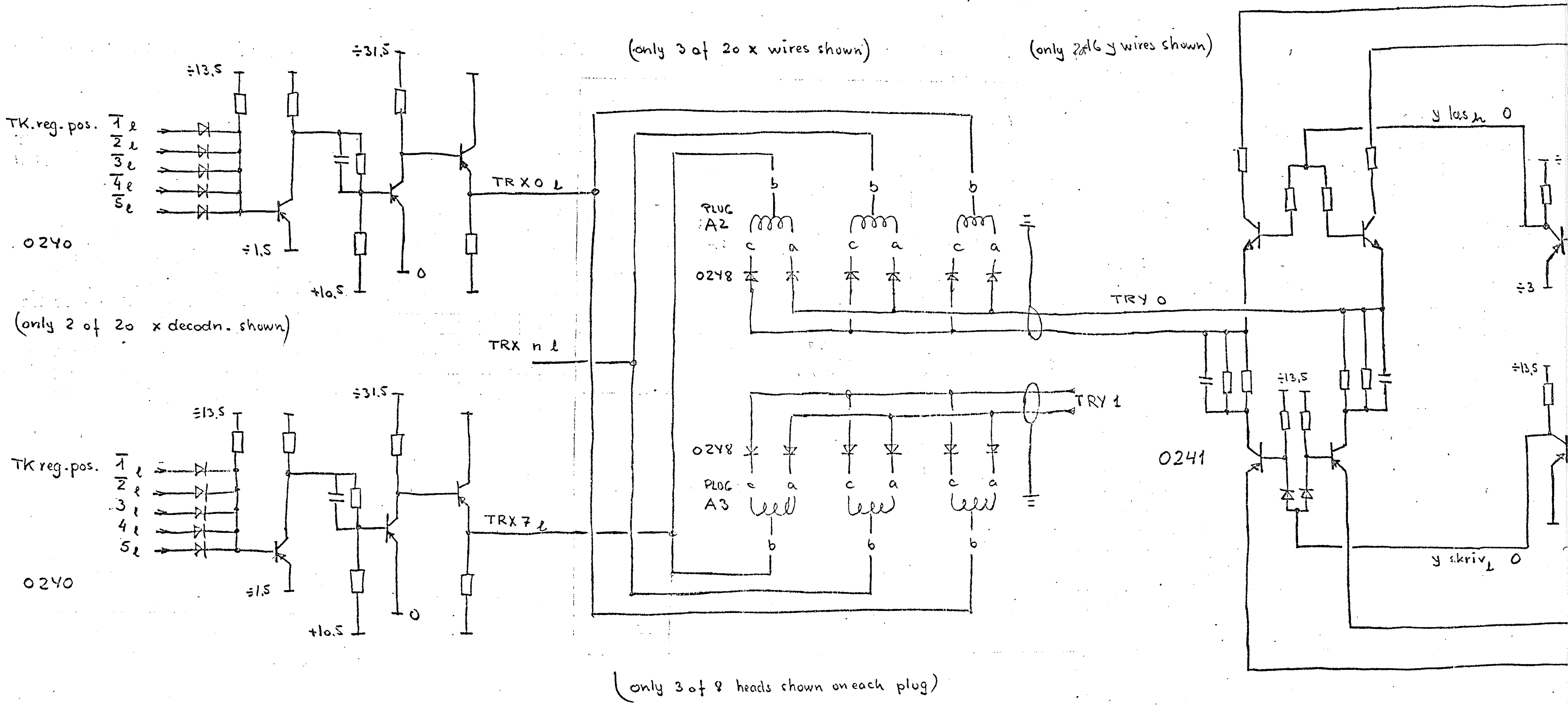
Unit: GIER 6	Designed H.I	Numbering and Location of Drum Tracks	Drawing No
REGNECENTRALEN	Approved		Drawn by R.H. 5.2.66
	Checked 1.2.62		Checked F.E. 20-2-67
	Last Revision		3 Sheets, Sheet 3
			248,-1-2

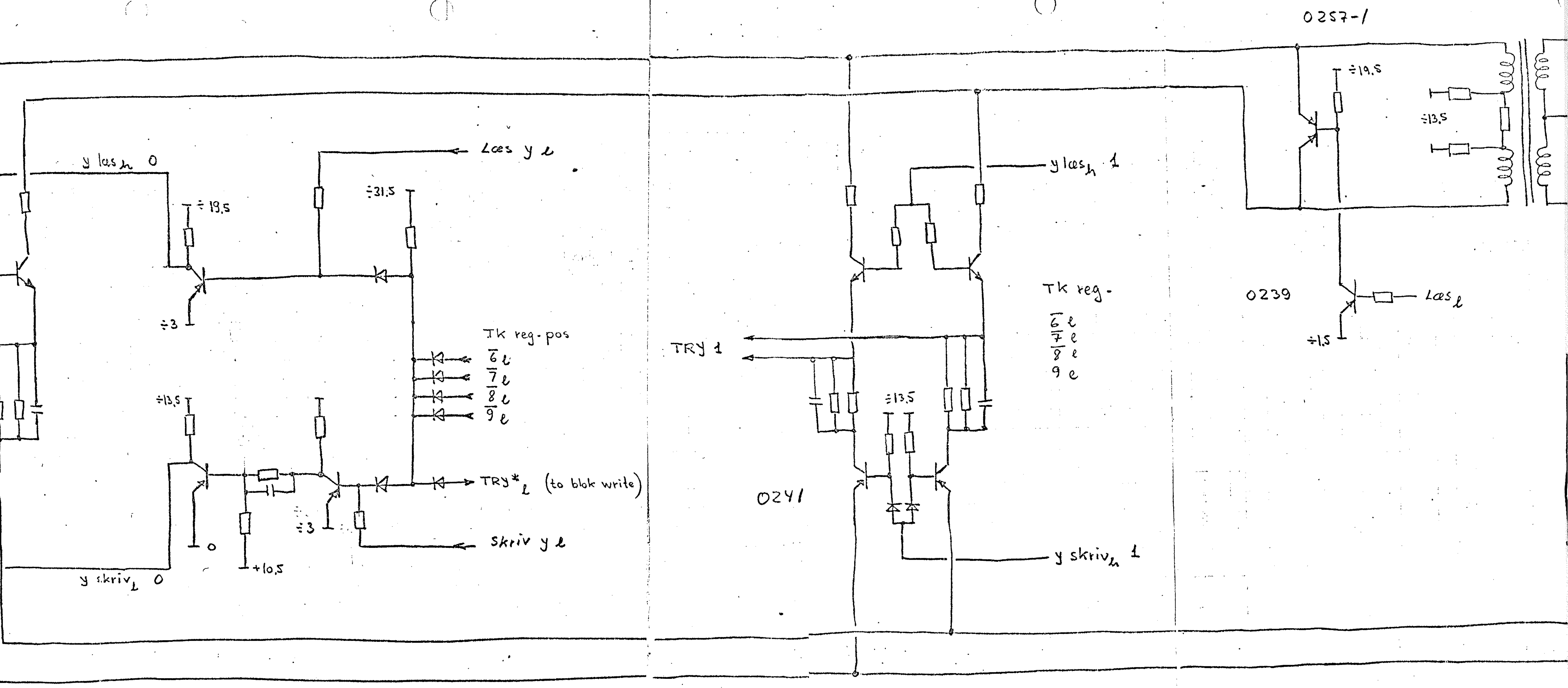


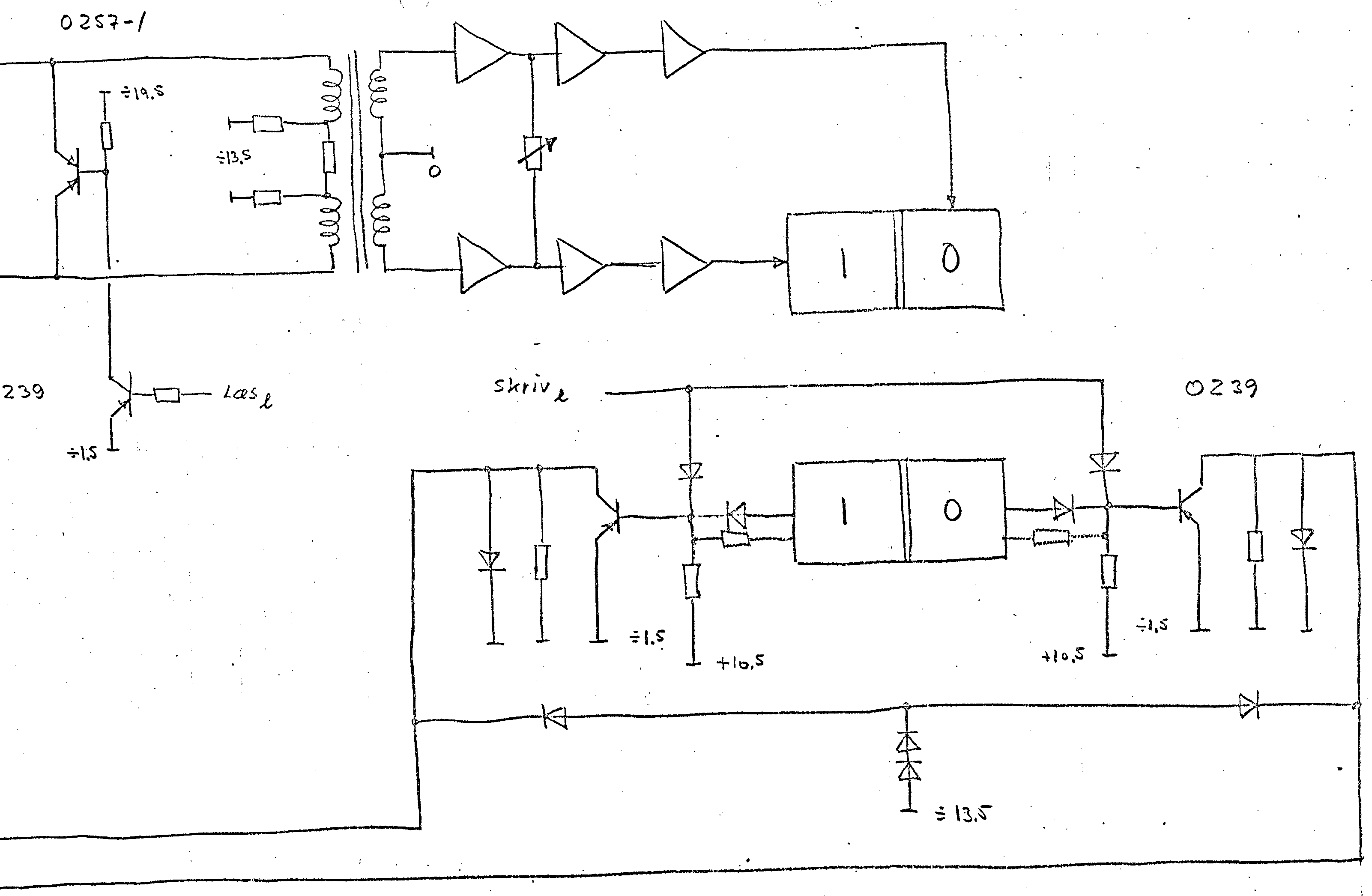
Unit: GIER 6	Designed H. I.	DRUM CLOCK PULSE AMPLIFIER	Drawing No	
A/S REGNE CENTRALEN	Approved		Drawn by B. R. 23. 8. 66	
	Checked 1. 2. 62.		Checked F. E. 22-2-67	
			2 Sheets	Sheet 2
	Last Revision		C 5	257



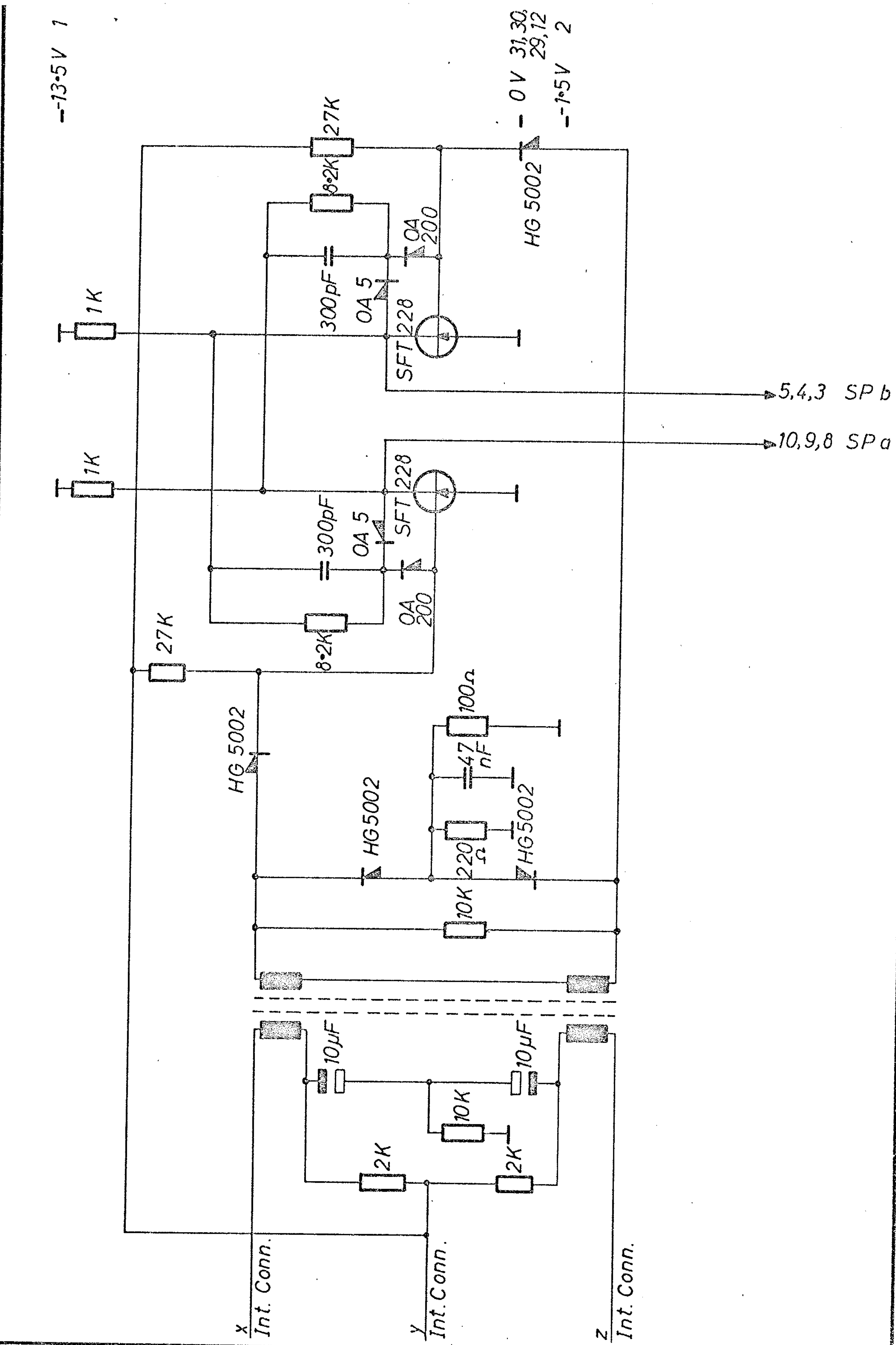
Unit: GIER 6	Designed H. I.	DRUM CLOCK PULSE AMPLIFIER	Drawing No
	Approved		Drawn by B. R. 23. 8. 66
REGNE CENTRALEN	Checked 1. 2. 62.		Checked F. E. 22-2-67
	Last Revision		2 Sheets — Sheet 1
			C5 — 257


(only 3 of 20 x wires shown)
(only 2 of 16 y wires shown)
TK.reg.pos. 1 2 3 4 5
0240
(only 2 of 20 x decodn. shown)
TRX 0
TRX n
TRX 7
PLUG A2
PLUG A3
0248
TRY 0
TRY 1
0241
y læs 0
y skriv 0
(only 3 of 8 heads shown on each plug)


0257-1
y læs_h 0
Læs y l
÷19,5
÷31,5
÷3
Tk reg-pos
6̄ l
7̄ l
8̄ l
9̄ l
÷13,5
TRY*_l (to blok write)
÷3
0
+10,5
skriv y l
y skriv_l 0
TRY 1
y læs_h 1
Tk reg.
6̄ l
7̄ l
8̄ l
9 l
÷13,5
0241
y skriv_h 1
÷19,5
÷13,5
0239
Læs_l
÷1,5



13/2-66 R. Hansen



Unit: GIER 6	Designed H. I.	DRUM SIGNAL AMPLIFIER	Drawing No
A/S REGNECENTRALEN	Approved		Drawn by B.R. 22.9.65.
	Checked 1. 2. 62.		Checked F.E. 22-2-67
	Last Revision		2 Sheets / Sheet 2
			Pos. C5-25 / 0257-1

4. Start-stop circuits

The clockpulses from the 450 KHz oscillator are distributed to different parts of the machine controlled by signals from the pushbuttons on the operators panel.

There are in priciple 3 different output-clockpulses:

1. KPA and KP.A which drives the microaddress flip-flops and gates in the control unit during normal operation.

2. KPB and KP.B which drives the special microaddress flip-flops and gates in the control unit during a drumtransfer function.

3. Display and 'zero to all lines' which drives the register-display-system that is active when the machine is stopped.

Besides this there are some special pulses (Sp-adder, SpH and SpMQ) which controls the shortterm-memories in the outputs of the adder and the registers H and MQ.

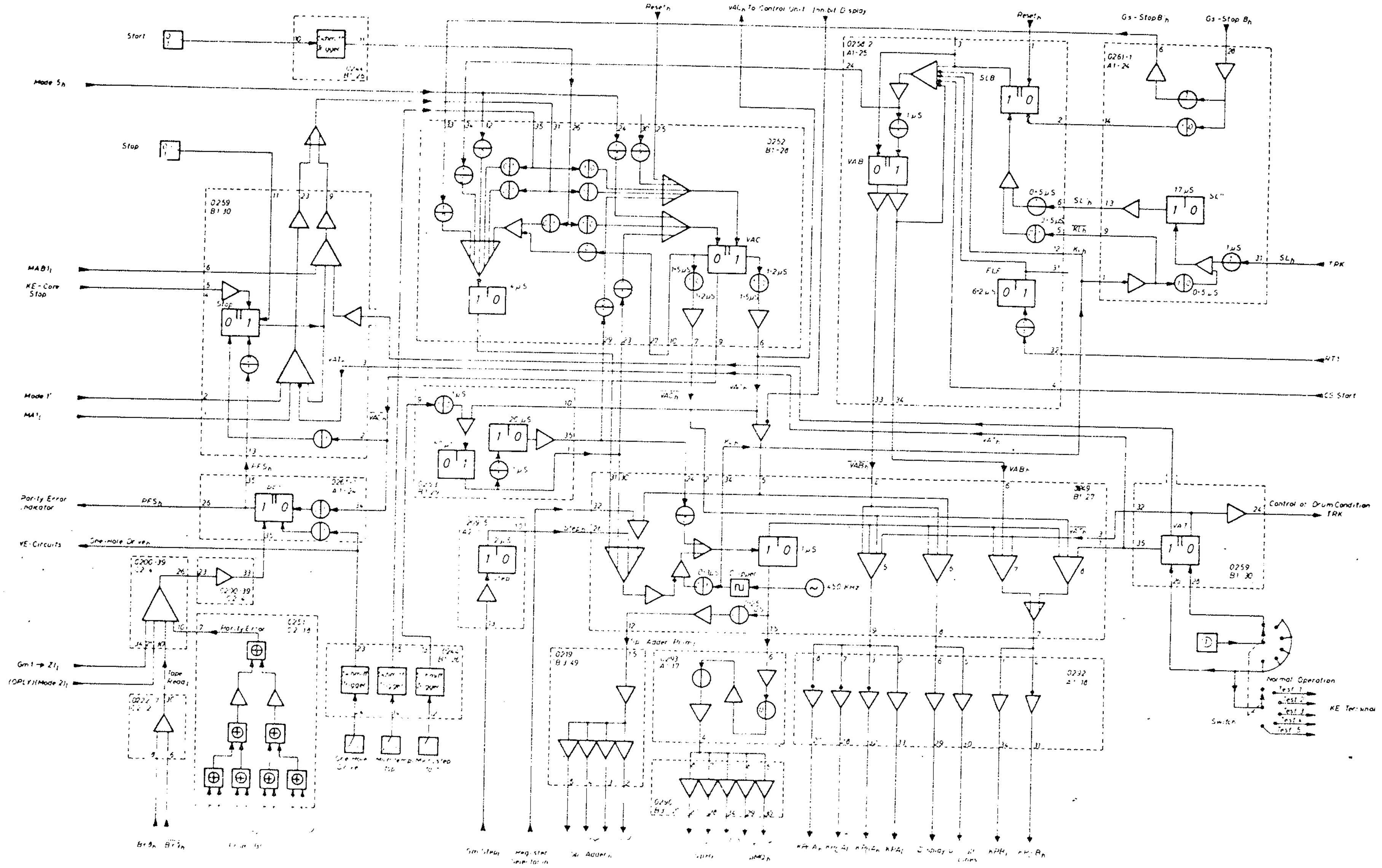
The distribution of clockpulses is controlled by means of the flip-flops VAC and VAB.

The flip-flop VAT is only one when the special testmicroprograms are activated by means of the switch in the central processor.

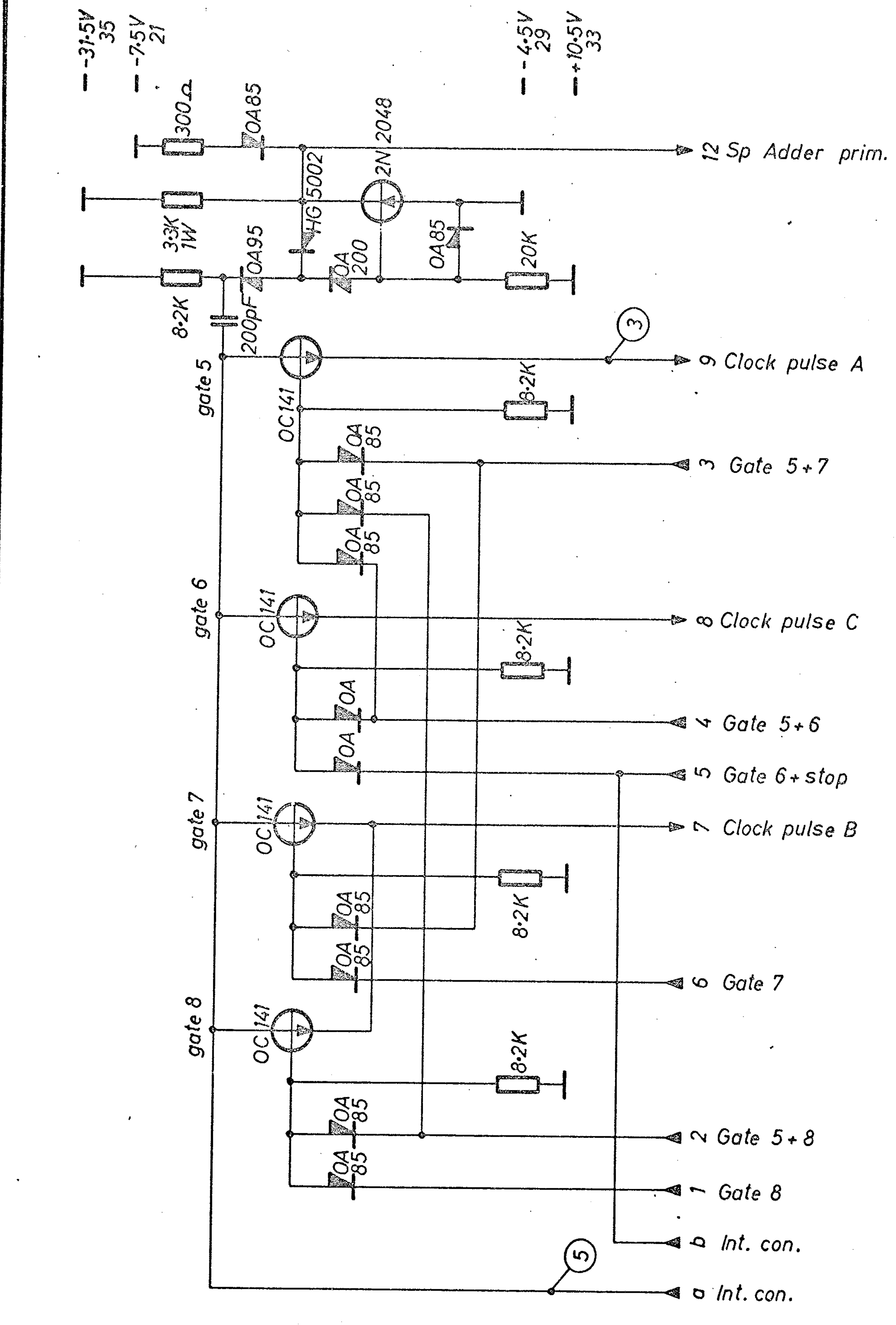
When VAC = 1 the outputgates for the display-system are enabled.
When VAC = 0 the machine is running and gate 5 on card 249 is enabled.
If VAB = 0 gate 5 will send outputpulses and KPA and KP.A will be active. If VAB = 1 gate 5 will be closed and gate 7 open so that KPB and KP.B will be active.

It is seen that if VAC = 1 and VAB = 1 gate 7 will still be active while display is inactive. This means that a drum transfer may be finished after VAC has been set to 1.

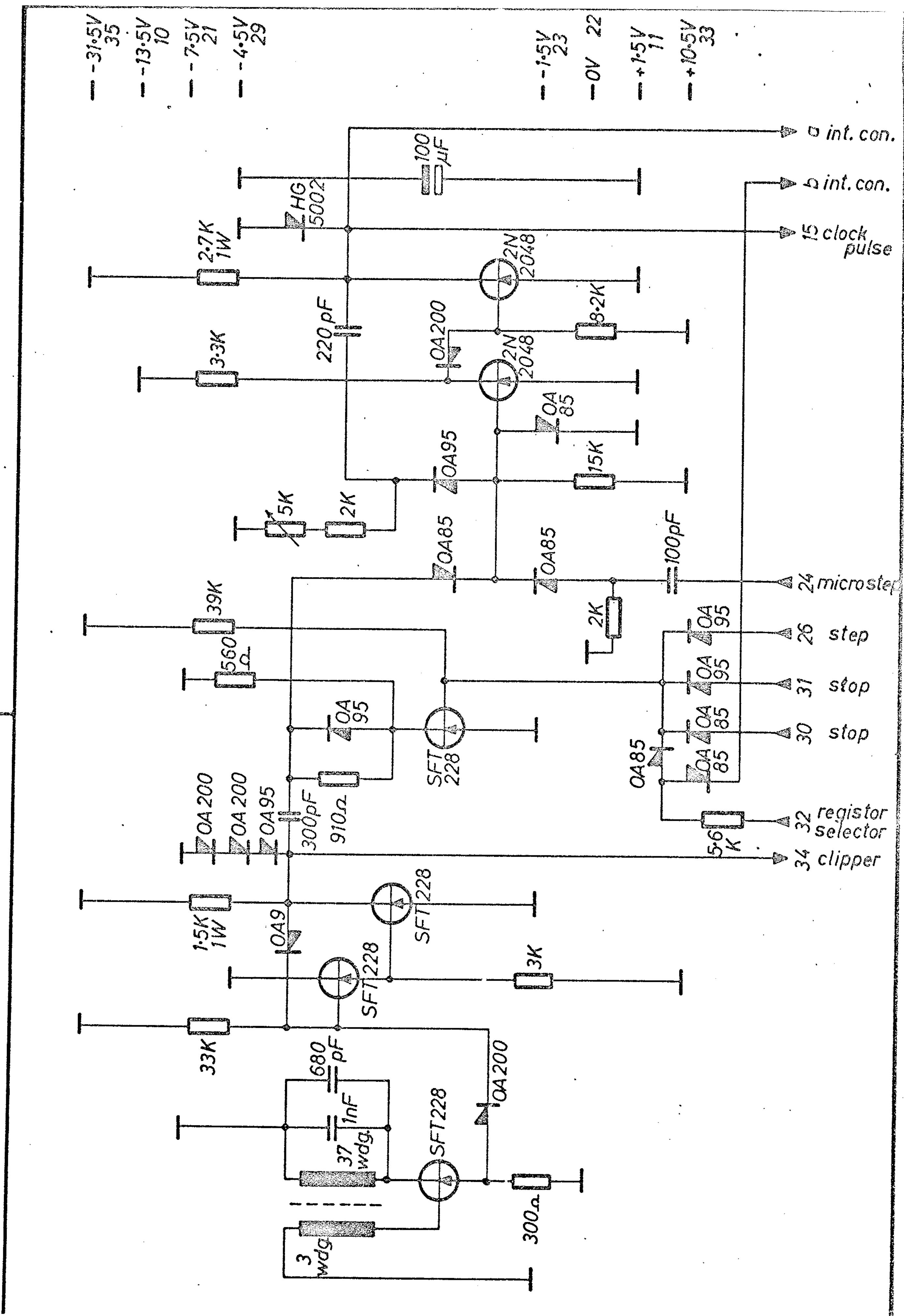
The primary clockpulse is interrupted in the following situations: after execution of microoperation Gmstep (1 clockpulse is removed), when VAC or VAB are changing or when pushbuttons are activated.
The logic around VAB is syncronizing the drumoperations and the clockpulse, and makes sure that a core-memory cycle is not interrupted by the drum.



GIER 6	Designed H.I.	START STOP CIRCUITS	Drawing N
REGNECENTRALEN	Approved		Drawn by BR 1-12-66
	Checked 1.2.62		Checked FE 26-2-67
	Last Revision		1 Sheets Sheet 1



Unit: GIER 6	Designed H. I.		Drawing No	
	Approved	OSC. AND CLIPPER	Drawn by G.T. 23. 9. 66.	
REGNE CENTRALEN	Checked 1. 2. 62.		Checked F.E. 22-2-67	
	Last Revision		2 Sheets	Sheet 1
			Pos. B1 - 27	249



Unit: GIER 6	Designed H. I.	OSC. AND CLIPPER	Drawing No
REGNECENTRALEN	Approved		Drawn by G.T. 23. 9. 66.
	Checked 1. 2. 62.		Checked F.E. 28-8-67
	Last Revision		2 Sheets / Sheet 2
			Pos. B1-27 / 249

8. Indicator circuits

The indicator operation is defined by means of the bits OR 33 and OR 34 in the following manner:

OR 33	OR 34	Name		Description
0	0	B_0	I	Storing in indicator
0	1	B_1	M	Marking of cell
1	0	B_2	N	Conditioning of instruction
1	1	B_3	L	- - -

It will be seen that each operation has two names. The names B_0-B_3 are only used in the technical papers. The decoding of the indicator-operation is done by the 'I -afk' on the card 222-2.

The indicator address is defined by means of the bits OR35 - OR39. The first 3 bits are decoded by means of the 'IA-afk' on the cards 222-1 in the following manner:

OR 35	OR 36	OR 37	Name	Description
0	0	0	N	Zerokombination
0	0	1	K	Push buttons on control panel
0	1	0	W or Z	Zero status of the R-gister
0	1	1	O	Overflow
1	0	0	T	Sign
1	0	1	P	Marking bits
1	1	0	Q	- -
1	1	1	R	- -

The two last bits of the address are used in the following manner:

OR 38	OR 39	Name
0	0	Zerokombination
1	0	A
0	1	B
1	1	C

The Indicator-register IN consists of 12 flip-flops with the names:
OA, OB, TA, TB, PA, PB, QA, QB, RA, RB, KA and KB.
The 10 first are connected to the busline-system and are placed upon the circuit cards 216-1. KA and KB can only be set manually from the control panel and are placed upon the card 200-5.

The specific functions of the indicator-logic are described in full detail in 'A Manual of GIER Programming', vol 1, page 90-95.

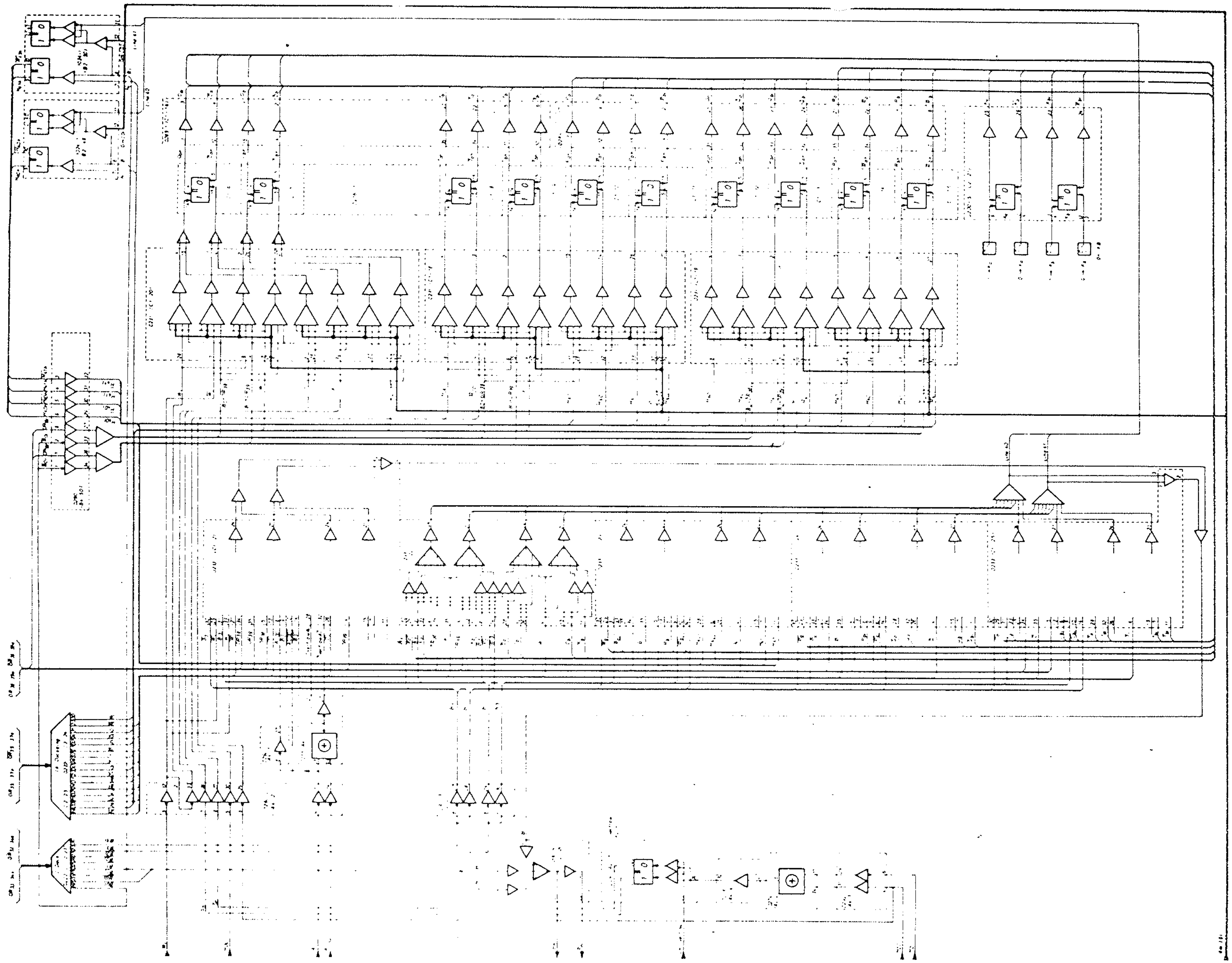
Conditioning of an instruction by means of indicatoroperations N or L is performed by a group of logic circuits which gives the outputsignal B.
If B = 1 the condition is fulfilled and the instruction will be executed.
This logic is placed upon the cards 233 and 200-9. The Boolean expression for B can be written in this way:

$$
\begin{aligned}
B = \; & (\overline{N} + \overline{B}_3 \cdot \overline{H}_{40} + B_3 \cdot H_{40} + \overline{OR}_{38})(\overline{N} + \overline{B}_3 \cdot \overline{H}_{41} + B_3 \cdot H_{41} + \overline{OR}_{39}) \cdot \\
& (\overline{K} + \overline{B}_3 \cdot \overline{K}_A + B_3 \cdot K_A + \overline{OR}_{38})(\overline{K} + \overline{B}_3 \cdot \overline{K}_B + B_3 \cdot K_B + \overline{OR}_{39}) \cdot \\
& (\overline{W} + \overline{B}_3 \cdot \overline{O}_A + B_3 \cdot O_A + \overline{OR}_{38})(\overline{W} + \overline{B}_3 \cdot \overline{O}_B + B_3 \cdot O_B + \overline{OR}_{39}) \cdot \\
& (\overline{W} + \overline{B}_3 \cdot \overline{w} + B_3 \cdot w + OR_{38} + OR_{39}) \cdot \\
& (\overline{O} + \overline{B}_3 \cdot \overline{O}_A + B_3 \cdot O_A + \overline{OR}_{38})(\overline{O} + \overline{B}_3 \cdot \overline{O}_B + B_3 \cdot O_B + \overline{OR}_{39}) \cdot \\
& (\overline{O} + \overline{B}_3 \cdot \overline{\text{overflow in AC}} + B_3 \cdot \text{overflow in AC} + OR_{38} + OR_{39}) \cdot \\
& (\overline{T} + \overline{B}_3 \cdot \overline{T}_A + B_3 \cdot T_A + \overline{OR}_{38})(\overline{T} + \overline{B}_3 \cdot \overline{T}_B + B_3 \cdot T_B + \overline{OR}_{39}) \cdot \\
& (\overline{T} + \overline{B}_3 \cdot \overline{AC}_{00} + B_3 \cdot AC_{00} \cdot OR_{38} + OR_{39}) \cdot \\
& (\overline{P} + \overline{B}_3 \cdot \overline{P}_A + B_3 \cdot P_A + \overline{OR}_{33})(\overline{P} + \overline{B}_3 \cdot \overline{P}_B + B_3 \cdot P_B + \overline{OR}_{39}) \cdot \\
& (Q + \overline{B}_3 \cdot \overline{Q}_A + B_3 \cdot Q_A + \overline{OR}_{38})(\overline{Q} + \overline{B}_3 \cdot \overline{Q}_B + B_3 \cdot Q_B + \overline{OR}_{39}) \cdot \\
& (\overline{R} + \overline{B}_3 \cdot \overline{R}_A + B_3 \cdot R_A + \overline{OR}_{38})(\overline{R} + \overline{B}_3 \cdot \overline{R}_B + B_3 \cdot R_B + \overline{OR}_{39}) \cdot
\end{aligned}
$$

In the case that indicatoroperation L is used then we have B 3 = 1. For operation N we have B 3 = 0 in the expression. By selecting an address f.ex. P, we have P = 1 and $\overline{P} = 0$. This means that only the paranthes containing $\overline{P}$ is interesting, because all other addresses N, K, W, O, T, [illegible] and R = 0 that is $\overline{N}$, $\overline{K}$, $\overline{W}$, ... $\overline{R} = 1$ so that all the rest of the parantheses are equal to 1. The expression simplifies in this case

For B 3 = 1 to $B = (PA + \overline{OR}_{38}) (PB + \overline{OR}_{39})$ and

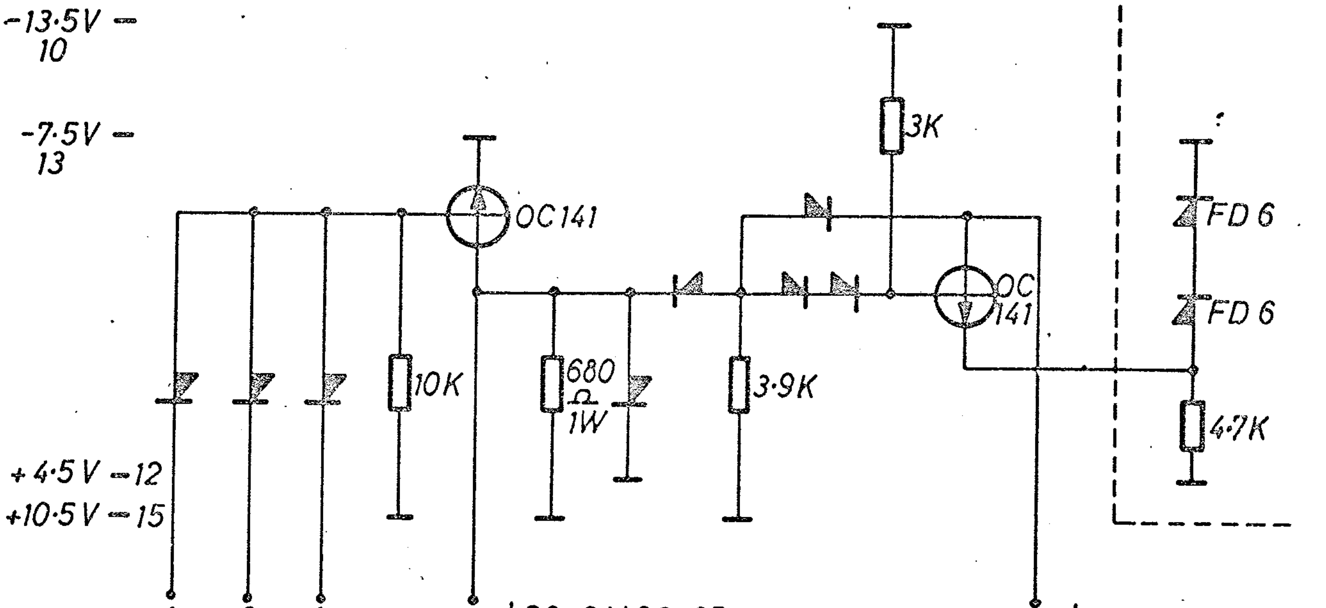
for B Z = 1 to $B = (\overline{PA} + \overline{OR}_{38}) (\overline{PB} + \overline{OR}_{39})$.



Unit GIER 6	Designed H. I.	BLOCK DIAGRAM FOR INDICATOR	Drawing No
REGNECENTRALEN	Approved		Drawn by DR 7-12-66
	Checked 1.2.62.		Checked FE 26-2-67
	Last Revision		1 Sheets Sheet 1

4 Circuits per card.

1 Circuit per card.



4	6	8
4	6	7
4	5	8
4	5	7

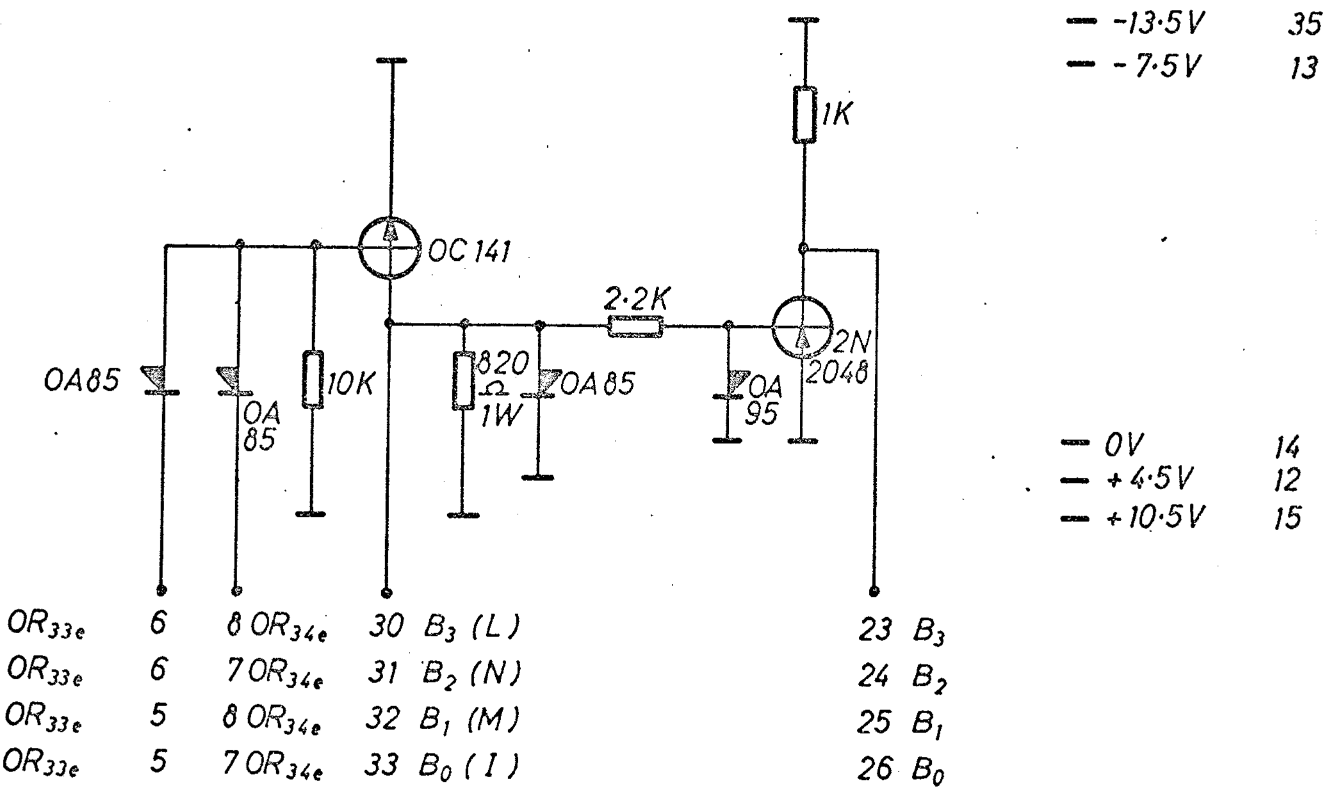
	C2-24	C2-25
30	R	O
31	Q	W
32	P	K
33	T	N

	C2-24	C2-25
23	$\overline{R}$	$\overline{O}$
24	$\overline{Q}$	$\overline{W}$
25	$\overline{P}$	$\overline{K}$
26	$\overline{T}$	$\overline{N}$

Unmarked Diodes : OA85

Unit: GIER 6	Designed H. I.	DECODING OF IA	Drawing No
REGNECENTRALEN	Approved		Drawn by G.T. 23. 5. 66.
	Checked 1. 2. 62.		Checked F.E. 22-8-67
	Last Revision		1 Sheets / Sheet 1
			Pos. C 2 / 0222 - 1

4 Circuits per card.



Unit: GIER 6

REGNECENTRALEN

Designed H. I.

Approved

Checked 1..2. 6.2.

Last Revision

DECODING OF 10

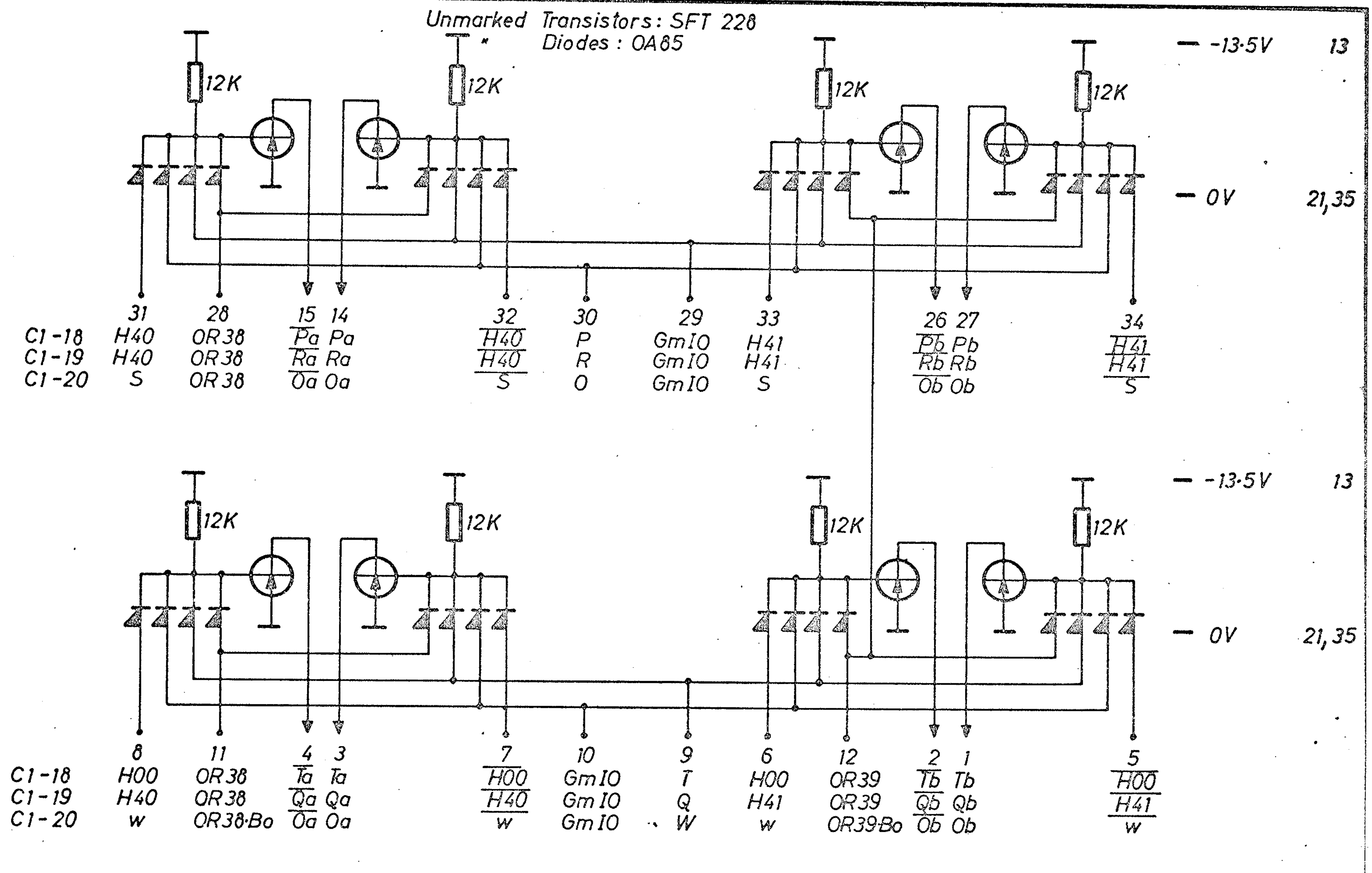
Drawing No

Drawn by G.T. 23. 5. 66

Checked F.E. 22-2-67

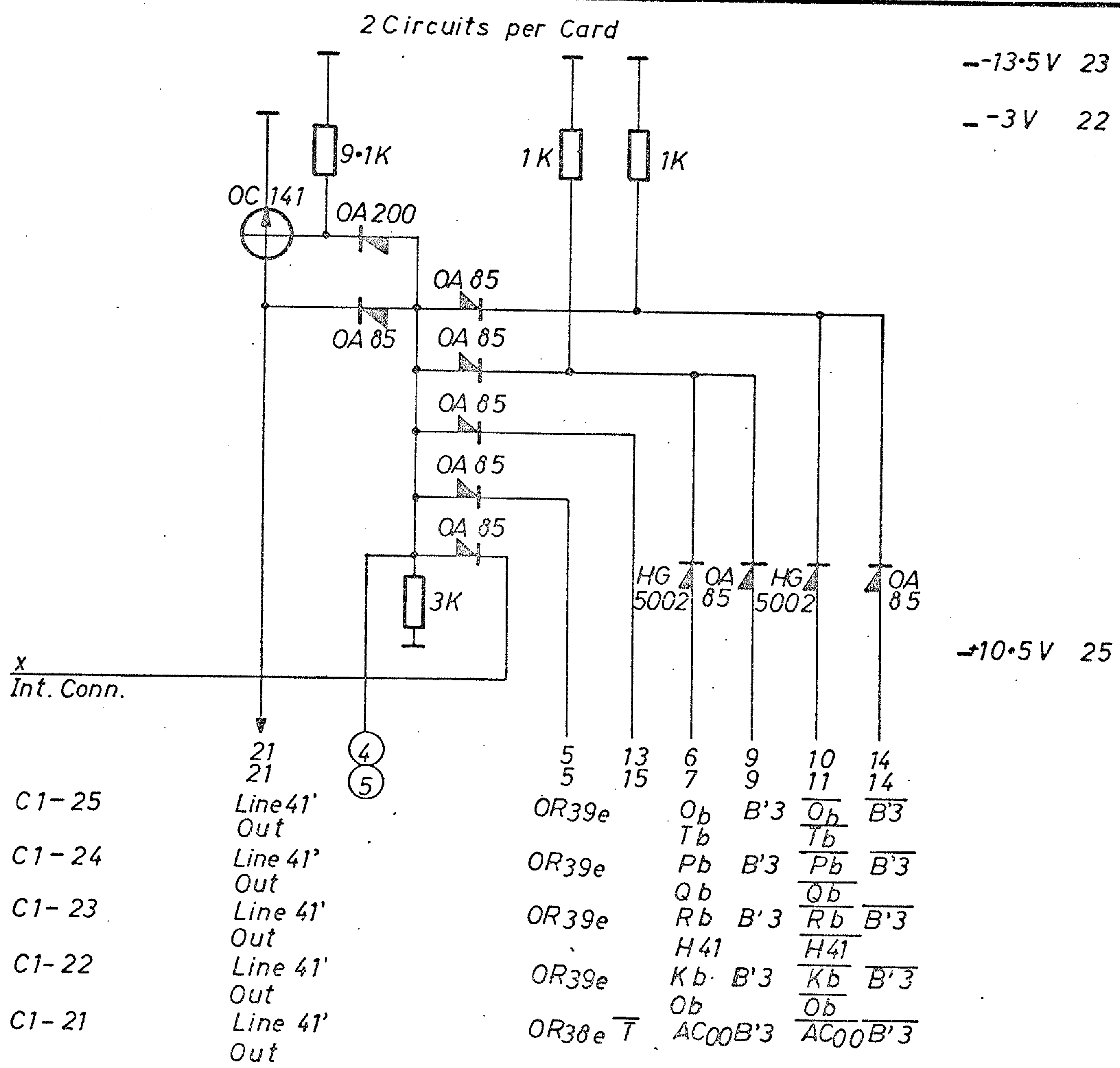
1 Sheets Sheet 1

Pos. C2-23 0222 - 2



S ~ overflow from overflow fl. fl., w = 0 for (AC) ≠ 0, W = 1 for (AC) = 0, GmIO ~ set indicator.

Unit: GIER 6	Designed H. I.	CONTROL OF INDICATOR	Drawing No
REGNECENTRALEN	Approved		Drawn by G. T. 13. 6. 66.
	Checked 1.2.62.		Checked F.E. 22-2-67
	Last Revision		1 Sheets — Sheet 1
			P C1 0231



Unit: GIER 6

REGNE CENTRALEN

Designed H. I.

Approved

Checked 1. 2. 62.

Last Revision

INDICATOR OPERATIONS

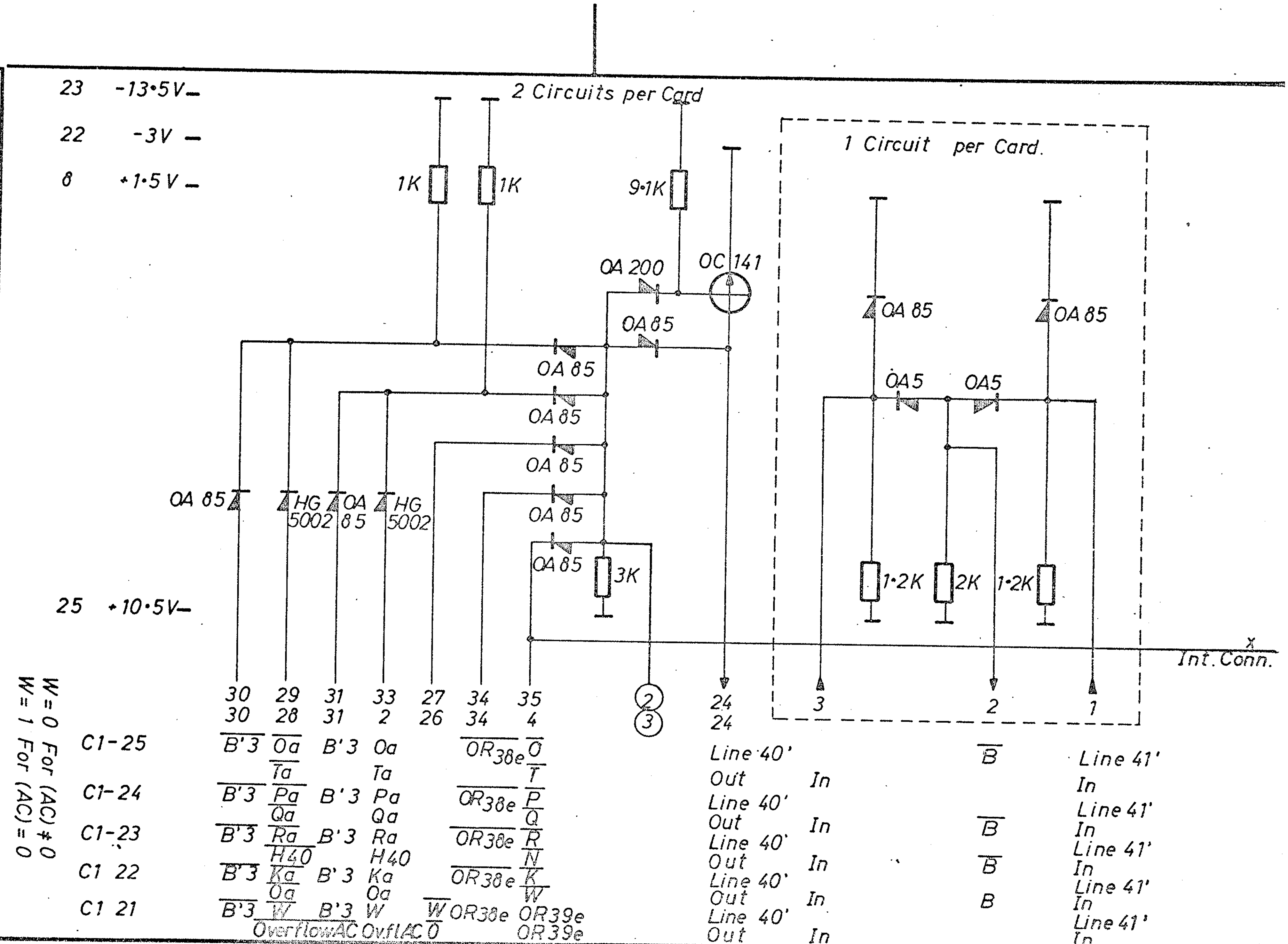
Drawing No

Drawn by B.R. 6. 10. 66.

Checked F.E. 22-2-67

2 Sheets | Sheet 1

Pos. C1 | 0233



Unit: GIER 6

REGNECENTRALEN

Designed H. I.

Approved

Checked 1. 2. 62.

Last Revision

INDICATOR OPERATIONS

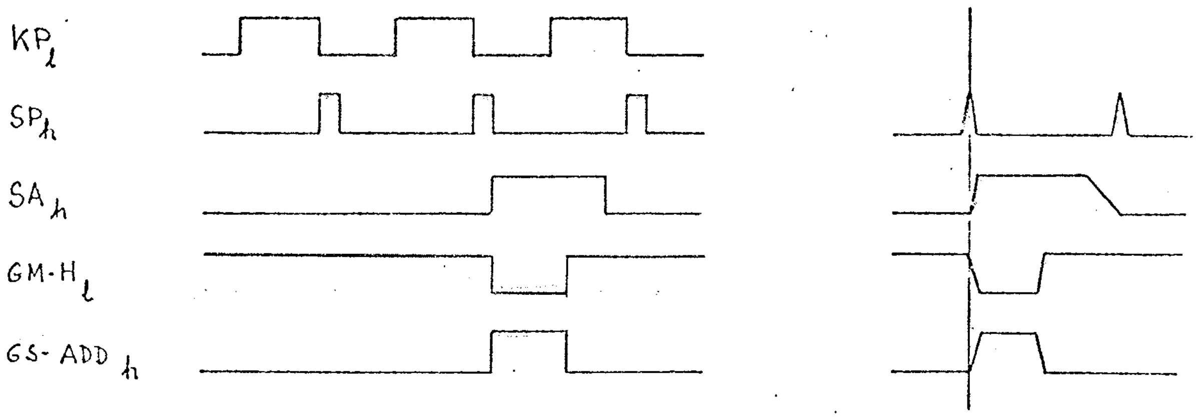
Drawing No

Drawn by B.R. 6. 10. 66.

Checked F.E. 22-2-67

2 Sheets Sheet 2

Pos. C 1 0233



ADD.

MD	0	1	0	0	1	1	0	1
H	0	0	1	0	1	0	1	1
Mi	0	0	0	1	0	1	1	1
y	1	0	1	1	0	0	1	0
x	1	0	0	1	1	0	0	1
S	0	1	1	1	0	0	0	1
Mu	0	0	0	0	1	1	1	1

$y \sim MD = 0$ $\quad \overline{y} \sim MD = 1$
$x \sim MD = H$ $\quad \overline{x} \sim MD \neq H$

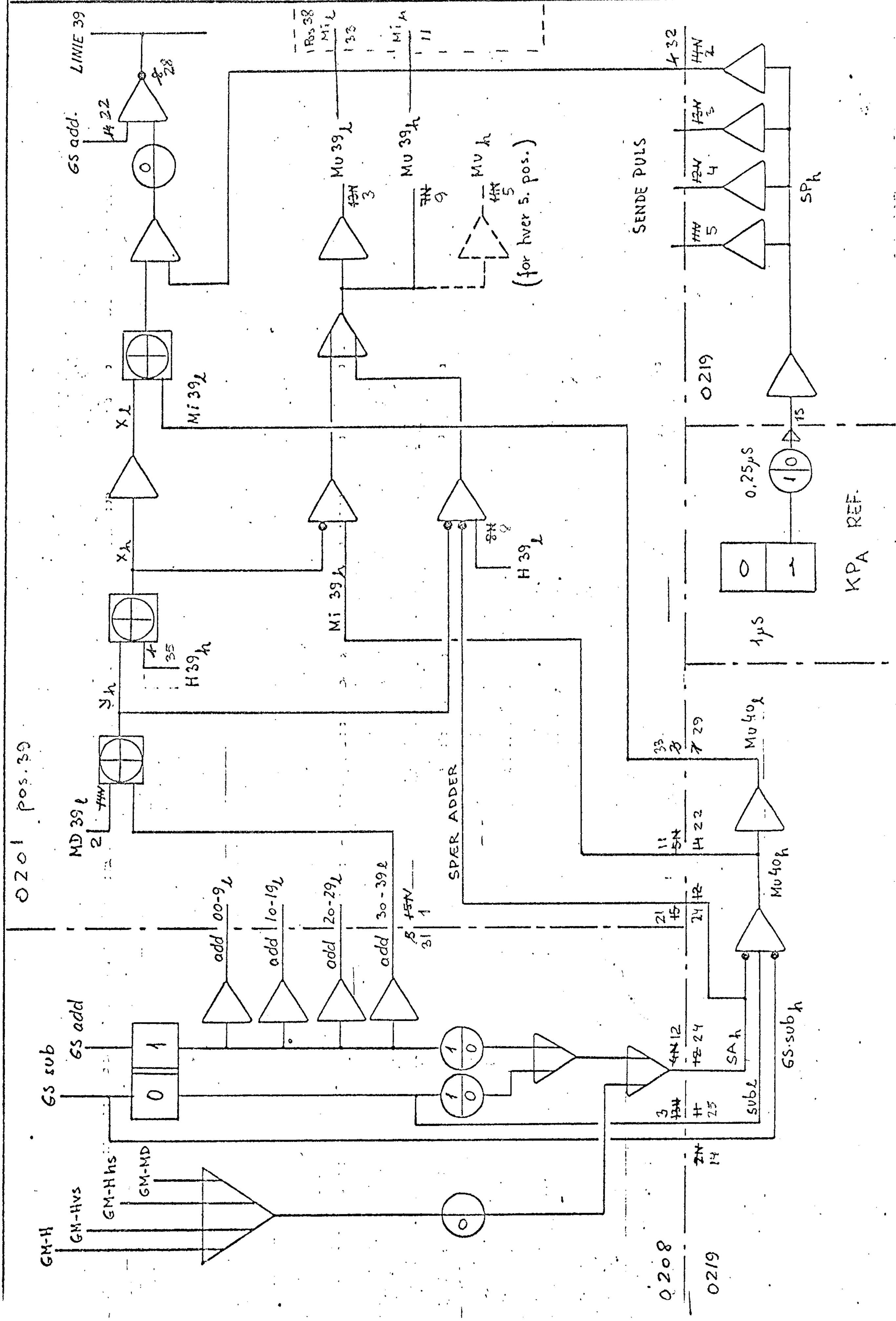
SUB.

MD	0	1	0	0	1	1	0	1
H	0	0	1	0	1	0	1	1
Mi	0	0	0	1	0	1	1	1
y	0	1	0	0	1	1	0	1
x	0	1	1	0	0	1	1	0
S	1	0	0	0	1	1	1	0
Mu	0	0	1	1	0	0	1	1

$y \sim MD = 1$ $\quad \overline{y} \sim MD = 0$
$x \sim MD \neq H$ $\quad \overline{x} \sim MD = H$

RC.

% REGNECENTRALEN	Emno: RI	AL		Sign.	Side TO.
	ADDER POS. 39		12/11 1965	KH	2/4



GIER VI

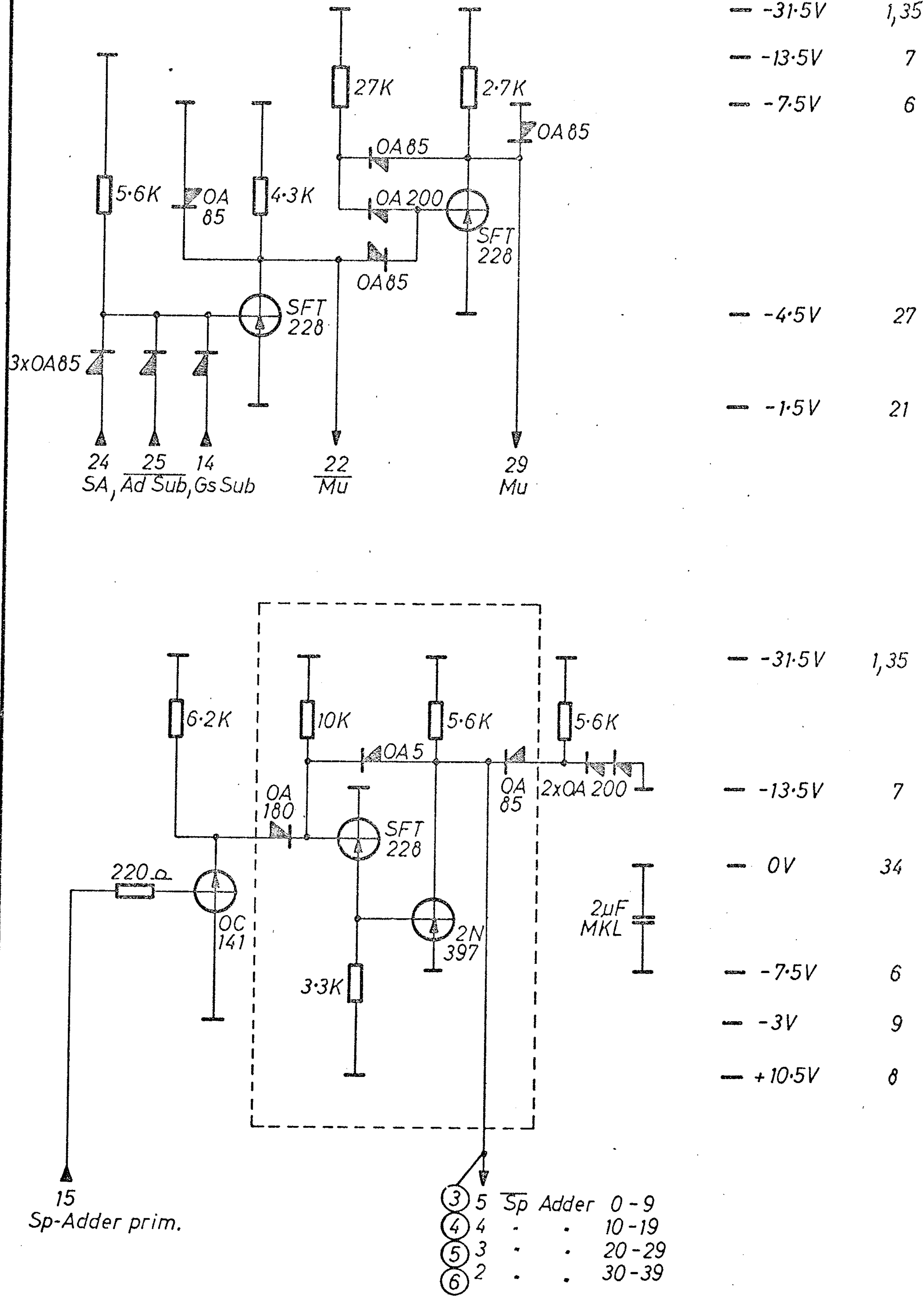
Halvadderen bestående af de to emitterfølgere OC47 og 750Ω, vil såfremt x = Mi, have samme spænding på base og emitter og begge OC 47 vil være blok. Basen af den efterfølgende OC141 vil ligge på ÷14, og denne vil være blokeret. Næste OC 141 vil derfor lede, og basen af GS-transistoren vil være ÷3, således at denne vil være blok. og linien vil forblive „1" under GS.

Såfremt x ≠ Mi vil een af OC 47 have ÷7,5 på basen og ÷ 4.5 på emittermodst. Transistoren vil lede og emitteren gå på ÷7.5 og over de 750Ω kan derfor leveres $\frac{7.5 \div 4.5}{0,75}$ = 4 mA. Hvis SP er negativ (÷15) skal disse 4mA leveres gennem 12k ≠ 3.3k ~ 2,5k og vil give et spænd. fald på 2.5 · 4 = 10 V., hvilket ville give en spænd. på ÷21.5 på col. af disse OC 47, men disse er klampet til ÷13.5 med en OA 160, som leverer den resterende strøm, således at punktet holdes på ÷14.

Herved er den efterfølgende OC 141 spærret.

Når SP går pos. (÷7,5) vil strømmen til de 3.3k leveres af denne. De 4 mA fra OC 47 skal da kun leveres gennem de 12k. Basen af OC141 kan ikke gå mere pos. end ÷13 før denne vil lede, og ved denne spænding vil der i 12k

gå $\frac{31.5 \div 13}{12}$ = 1.5 mA, de resterende 4 ÷ 1,5 = 2,5 mA er da til rådighed for basen på OC141 som vil lede og trække basen på den efterfølgende OC141 på ÷ 13,5 og samtidig oplade kondensatoren på 300 pF. Denne OC 141 vil være blok. fra SP går pos. og indtil kondensatoren er afladet. (ca 2μs) I dette tidsrum vil GS-Adder gå pos. og basen af GS-transistoren følge med således at denne leder og linien bliver trokket på ÷1,5 d.v.s. „0“



Unit: GIER 6

A/S REGNECENTRALEN

Designed H. I.

Approved

Checked 1. 2. 62.

Last Revision

SP - ADDER CARRIE 39

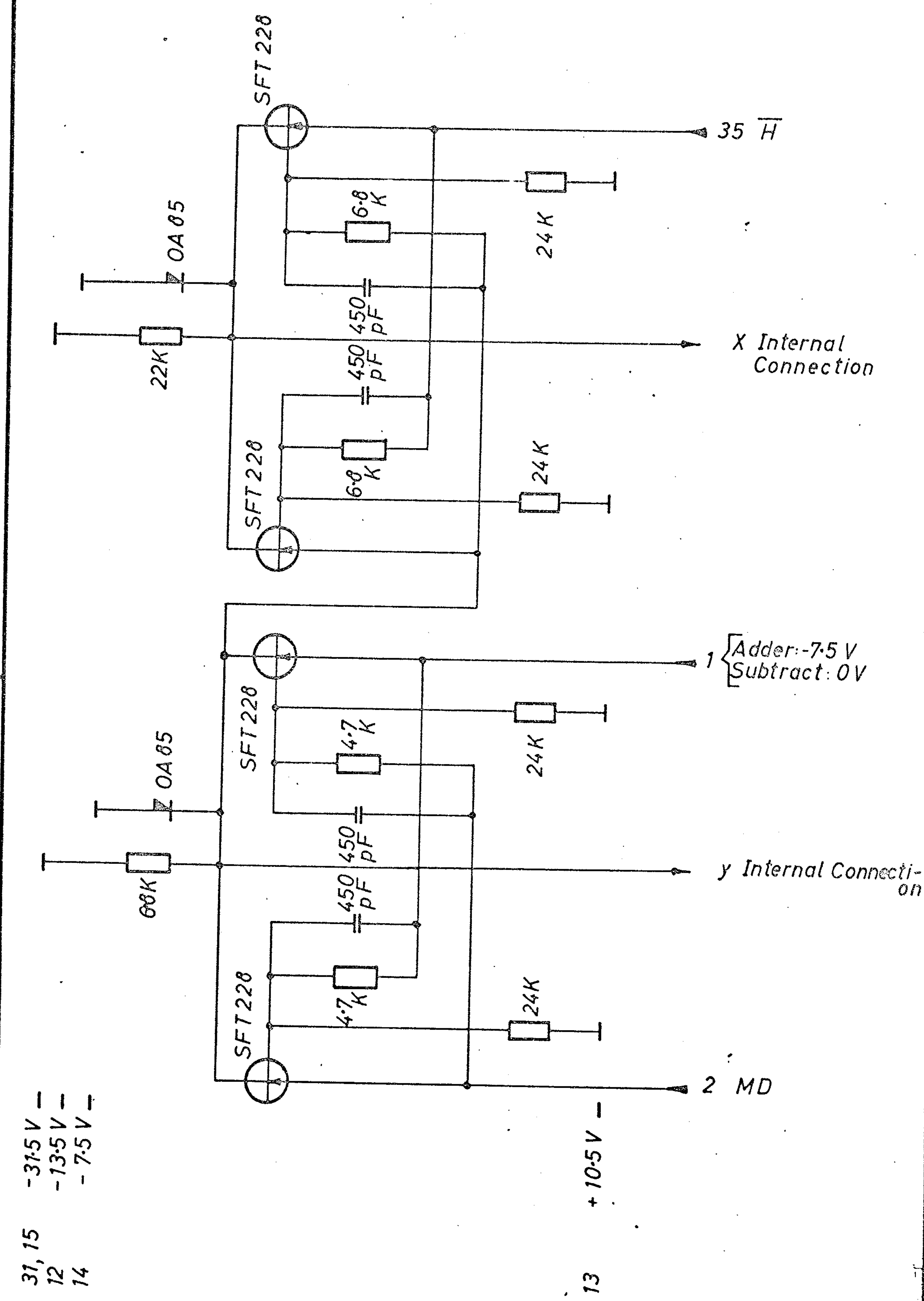
Drawing No

Drawn by G.T. 20. 5. 66.

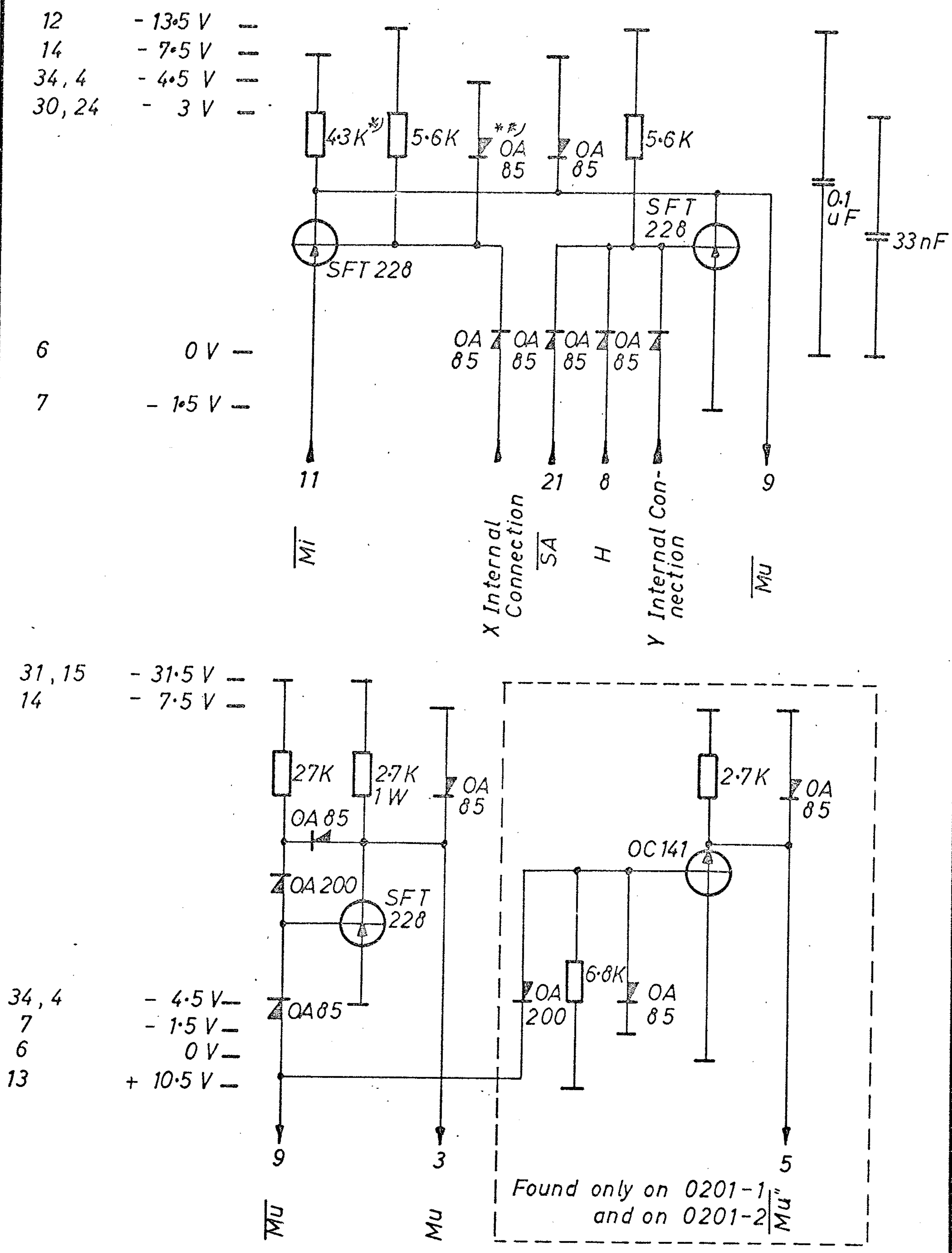
Checked F.E. 23-2-67

1 Sheets Sheet 1

Pos. B3-49 0219



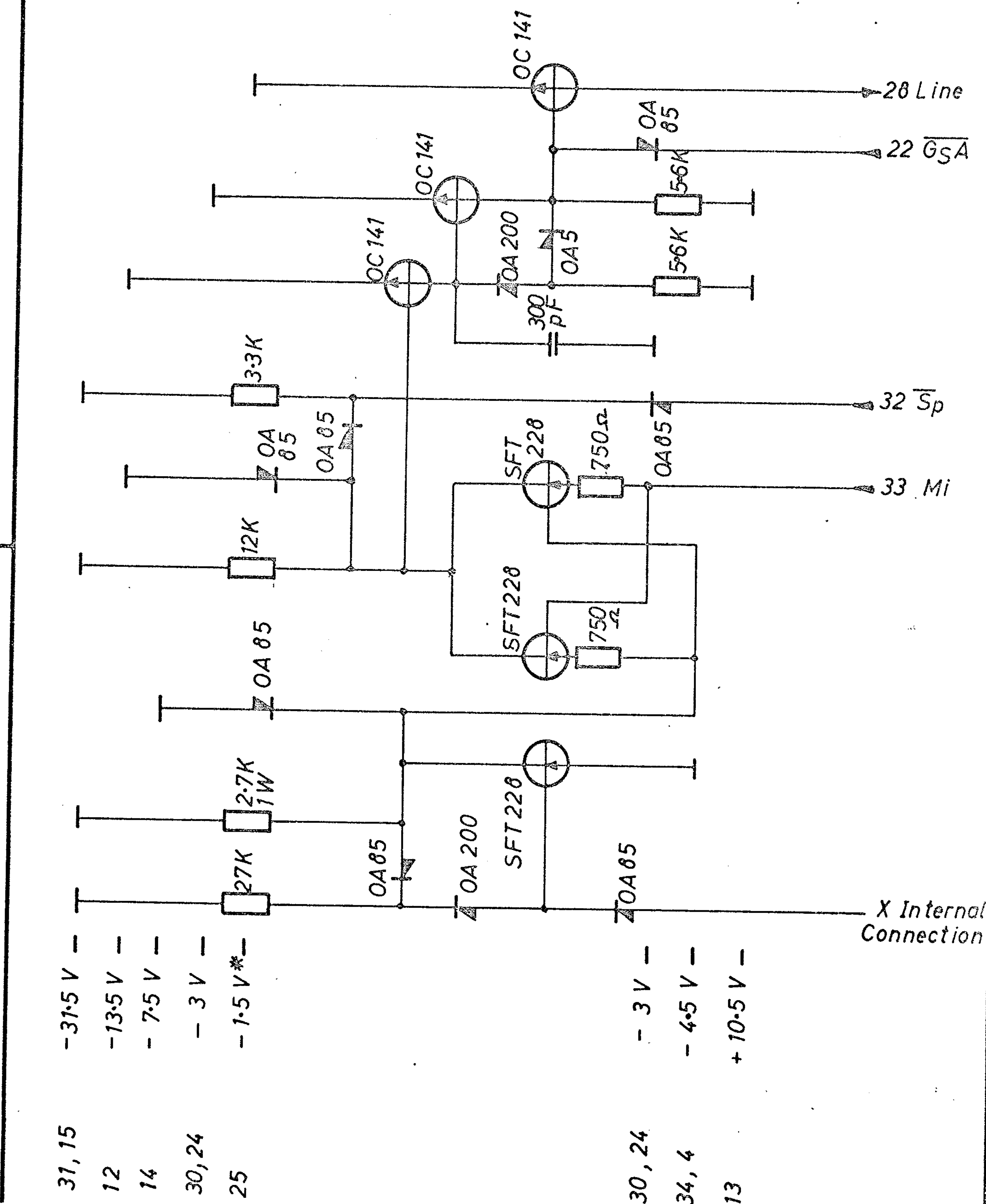
Unit: GIER 6	Designed H.I.	ADDER	Drawing No
REGNECENTRALEN	Approved		Drawn by B.R. 13. 1. 66.
	Checked 1.2.62.		Checked F.E. 22-8-67
	Last Revision		3 Sheets — Sheet 1
			A4-B3 — 02018-1-2



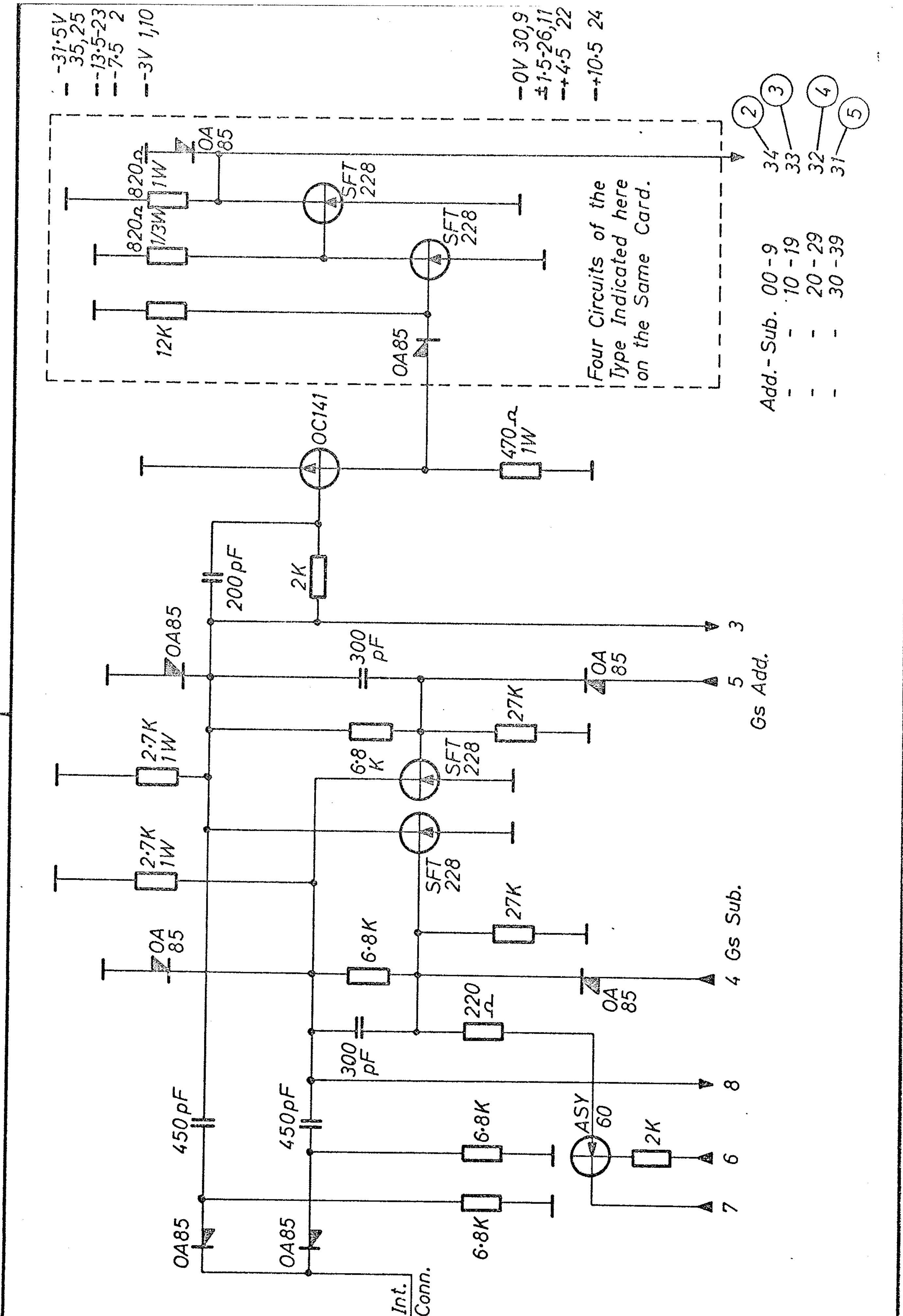
**) Found only on 0201-2

*) Value 5·1K and Connected to -31·5 V on Cards 0201-1 and 0201-2

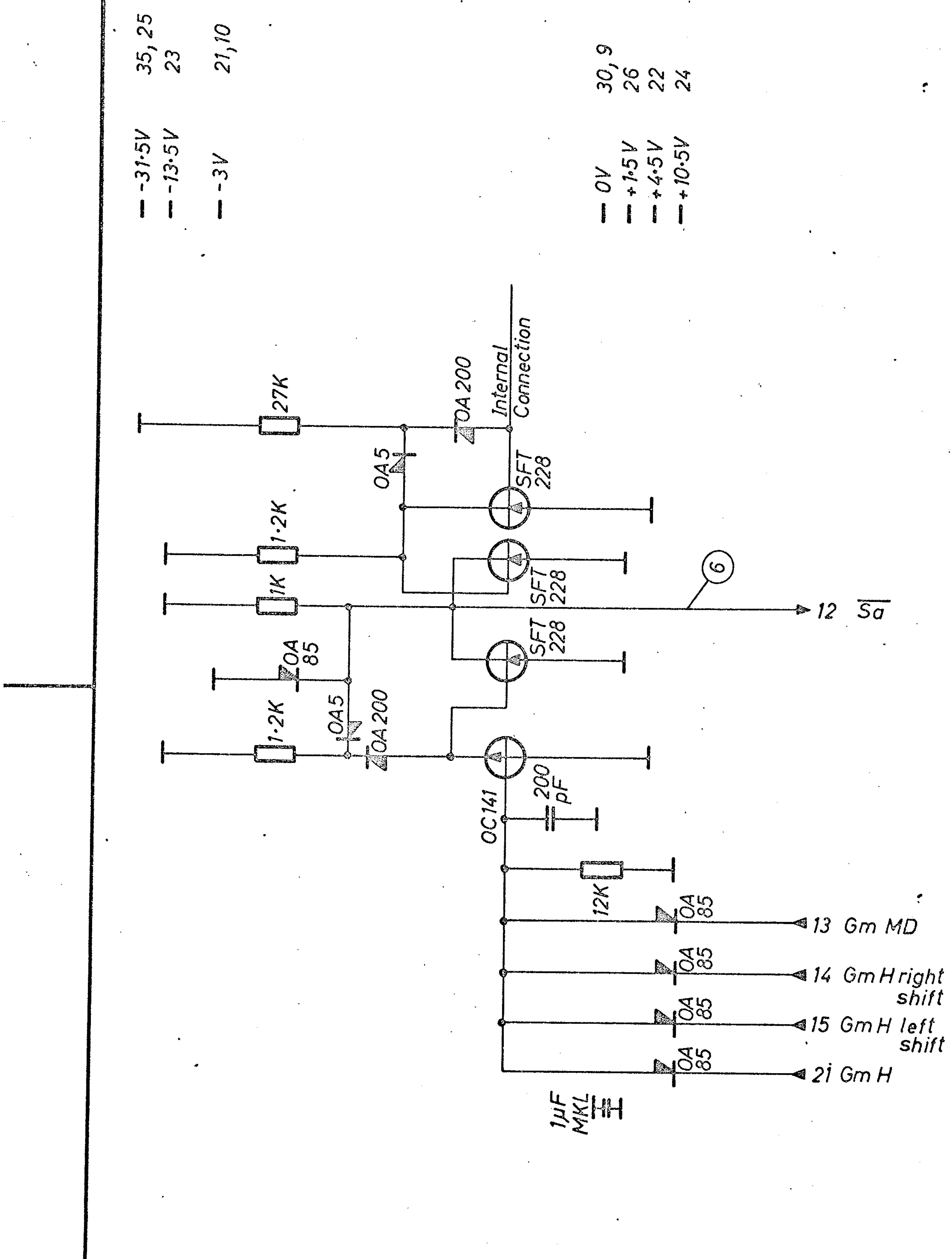
Unit: GIER 6	Designed H.I.		Drawing No
			Drawn by B.R. 13.1.66.
REGNE CENTRALEN	Approved	ADDER	Checked F.E. 23-2-67
	Checked 1.2.62.		3 Sheets · Sheet 3
	Last Revision		Pos. A4-B3 · 0201& -1 -2



Unit: GIER 6	Designed H.I.	ADDER	Drawing No
REGNECENTRALEN	Approved		Drawn by B.R. 13.1.66.
	Checked 1.2.62.		Checked F.E. 22-8-67
	Last Revision		3 Sheets / Sheet 2
			Pos. A4-B3 / 02018-1-2



Unit: GIER 6	Designed H. I.		Drawing No
REGNECENTRALEN	Approved	$\overline{SA}$ AND ADD.-SUB.-FL.-FL.	Drawn by G.T. 16.1.67
	Checked 1.2.62		Checked F.E. 22-2-67
	Last Revision		2 Sheets · Sheet 2
			B3-28 · 0208



Unit: GIER 6	Designed H I	$\overline{SA}$ AND ADD. - SUB. -FL. FL.	Drawing No
			Drawn by G. T. 17.1.67
REGNECENTRALEN	Approved		Checked F. E. 23-8-67
	Checked 1.2.62		2 Sheets / Sheet 1
	Last Revision		B3 - 28 / 0708

Unmarked Diodes: OA 95

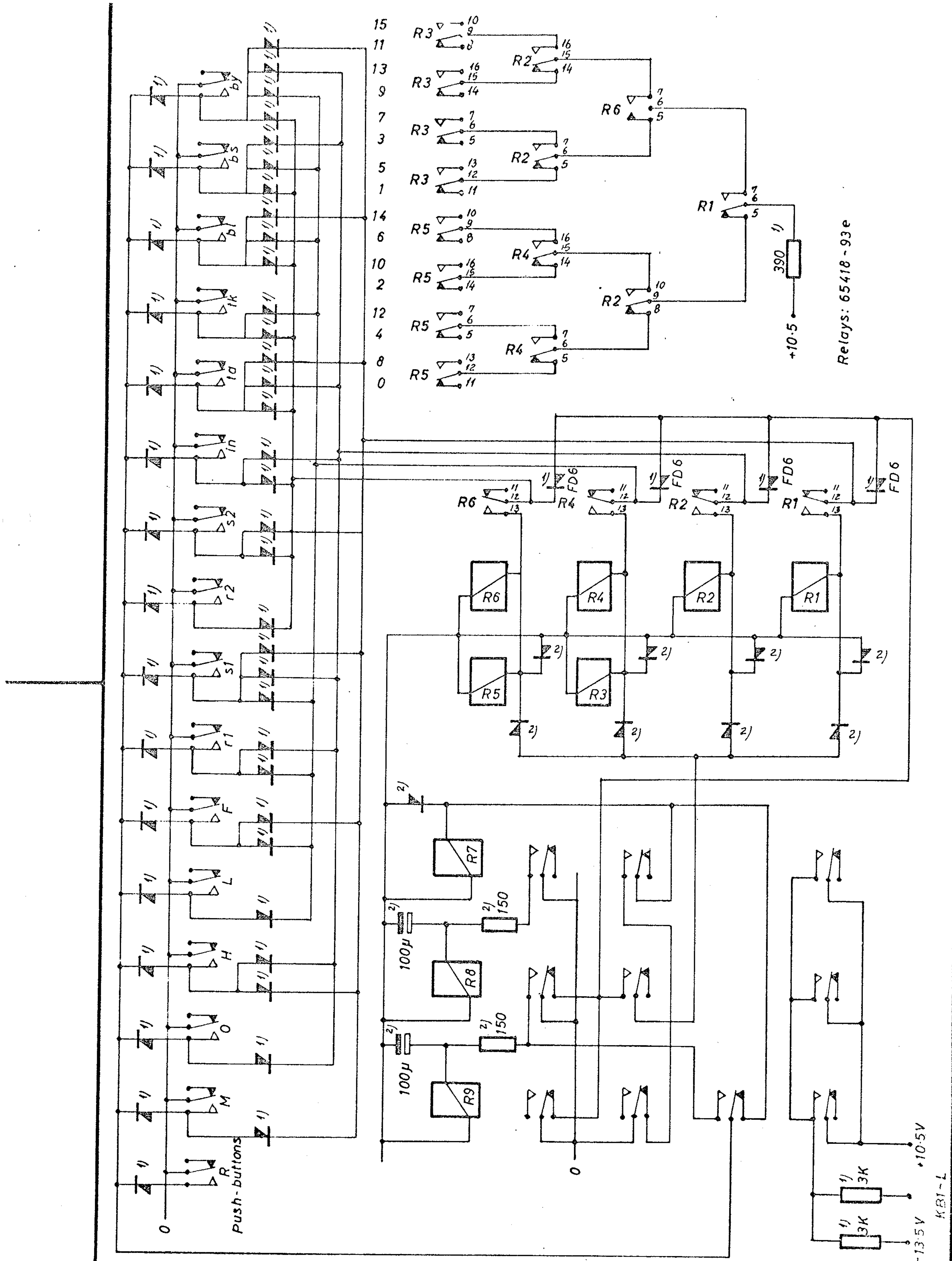
1) Mounted on Card 0255

2) Mounted on Relays

R	correspond	with	input	0	on	Card	0255
M	-	-	-	1	-	-	-
O	-	-	-	2	-	-	-
H	-	-	-	3	-	-	-
L	-	-	-	4	-	-	-
F	-	-	-	5	-	-	-
r1	-	-	-	6	-	-	-
s1	-	-	-	7	-	-	-
r2	-	-	-	8	-	-	-
s2	-	-	-	9	-	-	-
in	-	-	-	10	-	-	-
ta	-	-	-	11	-	-	-
tk	-	-	-	12	-	-	-
b1	-	-	-	13	-	-	-
bs	-	-	-	14	-	-	-
by	-	-	-	15	-	-	-

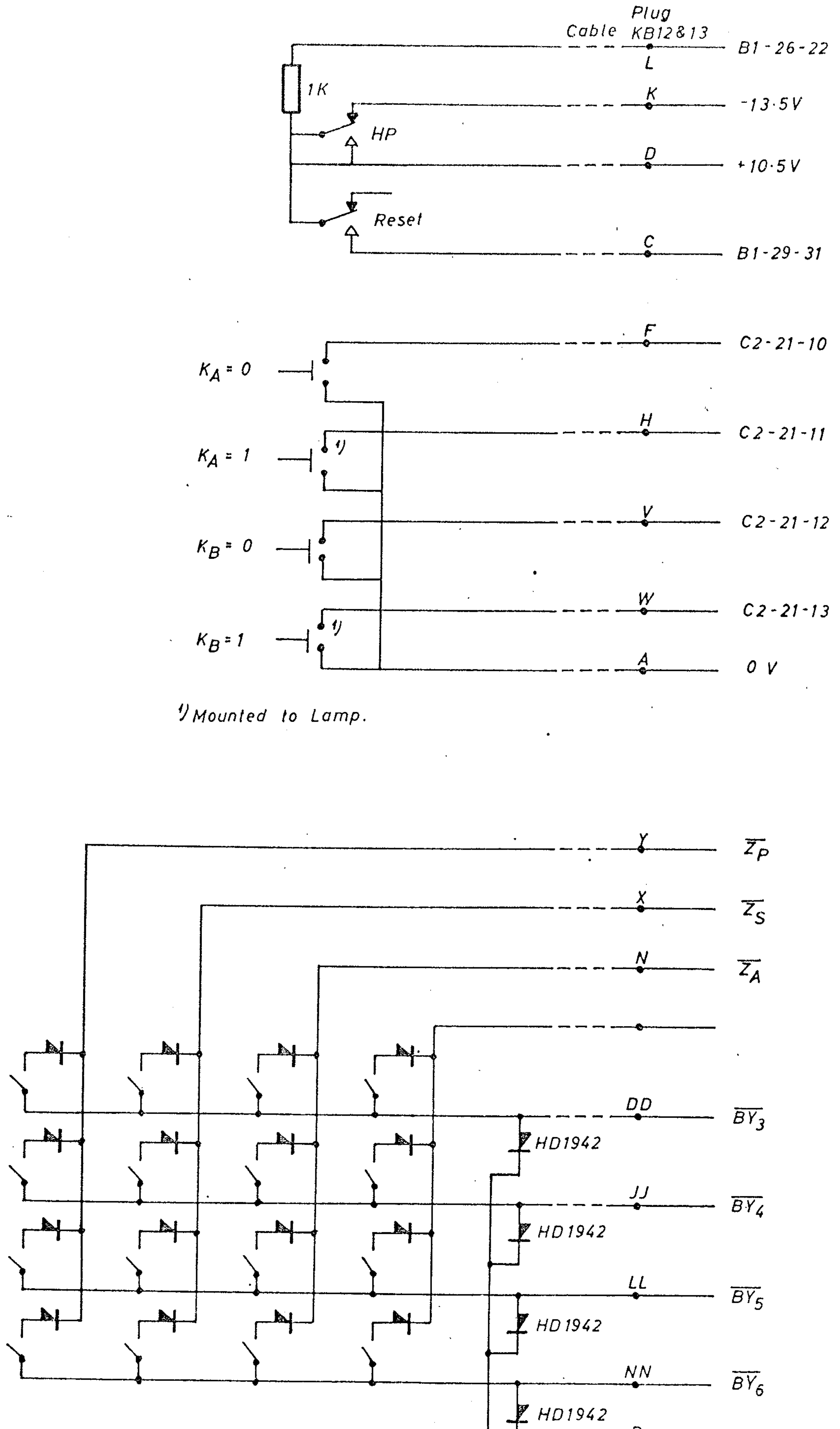
Relay 1-9, mounted in Display Panel beginning with Relay farthest from Hinge on Relayshelf.

Unit: GIER 6	Designed H.I.	Register Selector in KB.	Drawing No
			Drawn by I. 29.4.67
REGNECENTRALEN	Approved		Checked F.E. 7-8-67
	Checked 1.2.62		2 Sheets / Sheet 2
	Last Revision		



Unit: GIER 6	Designed H.I.	Register - Selector in KB	Drawing No
REGNECENTRALEN	Approved		Drawn by I.K. 28.4.1967
	Checked 1.2.1962		Checked F.E. 7-8-67
	Last Revision		2 Sheets Sheet 1

DISPLAY PANEL II



1) Mounted to Lamp.

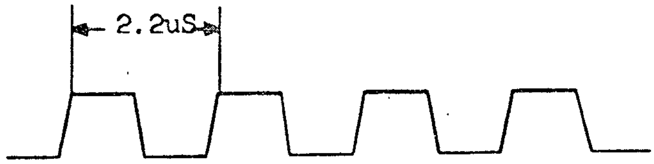
Unmarked Diodes: OA85

Unit: GIER 6	Designed H.I.	Push-Buttons in KBII	Drawing No
A/S REGNECENTRALEN	Approved		Drawn by I.K. 28.4.1962
	Checked 1.2.1962.		Checked F.E. 7-8-67
	Last Revision		1 Sheets — Sheet 1

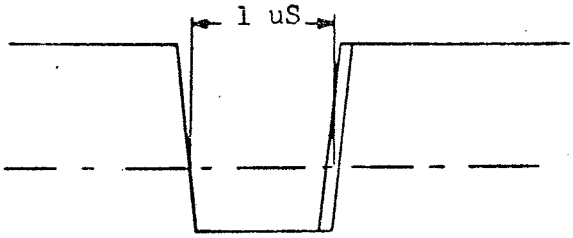
ADJUSTMENTS FOR GIER

CLOCKPULSE 0249 (B1-27)

The oscillator frequency is adjusted by changing the capitance (680 pF)



The clock pulse length can be adjusted by the potentiometer on card o249 and should be 1uS when measuring GM-H_{0-9} as it passes 0 V.

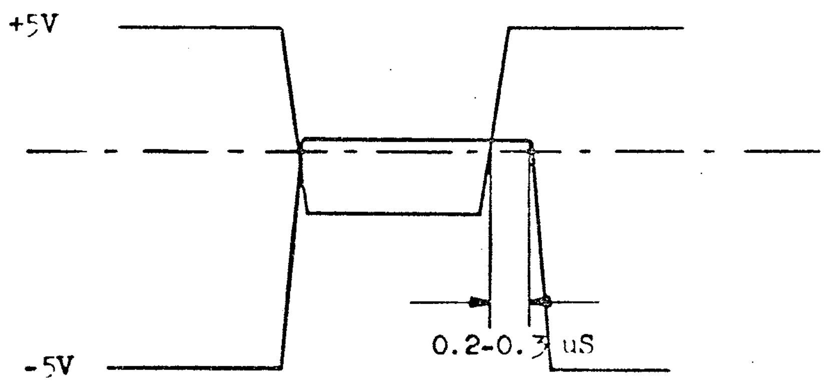


Marginal pulse length is 0,9uS to 1,1uS. (± 10%)

SP-H and MQ

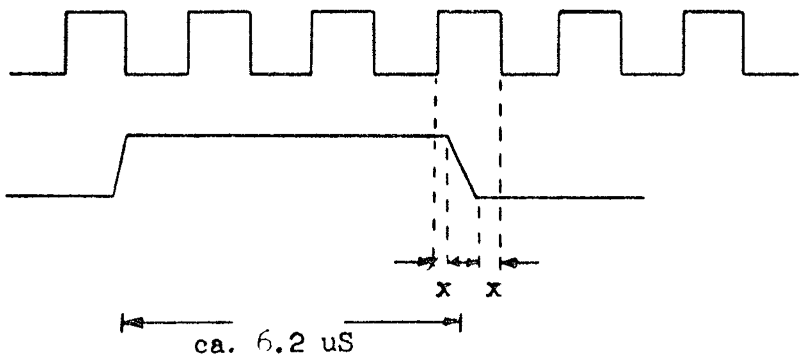
SP-H should start at the same time as GM-H and should lag behind 0.2-0.3uS.

Adjustment is made on 0293 (A1-17) by changing the capacitance.



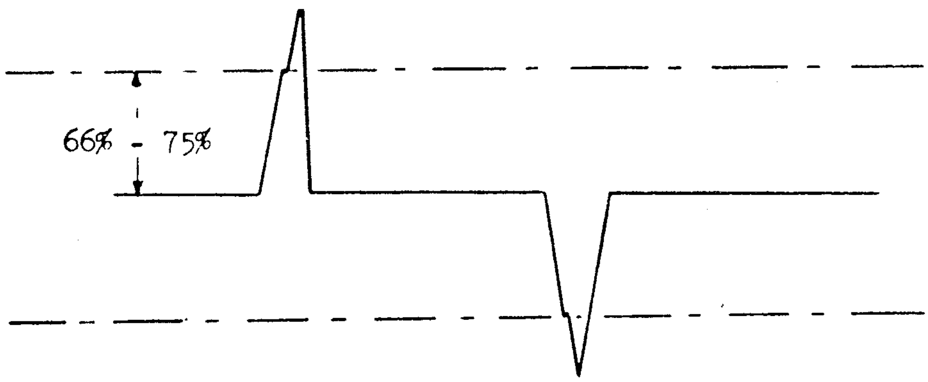
VAB: 0258 (A1 - 25)

The shift from KP_A to KP_B should take place on the trailing edge of a clock pulse. FLF can be adjusted on the potentiometer on A1-25, and should return to zero in the middle of a clock pulse after approx 6.2uS i.e. in the third clock pulse after start.



DRUM

KP I, II and III amplifiers should be adjusted so that triggering takes place between 66% and 75% of the pulse amplitude. Adjustment is made with the potentiometer on 0257.



Signal amplifier is adjusted with the potentiometer on 0257-1. During drumtest (all tracks involved) the potentiometer at first is slowly turned clockwise until an error appears, then counter-clocl wise until an error again appears. The potentiometer is now set in the middle of these two extremes.

FORWARD/BRAKE COILS:

Current in these coils is adjusted to 3 amp. with help of the variable resistor 4.7 60W, mounted under the console.

VOLTAGE

All voltages are adjusted with potentiometers on the control panel, to 100%, and should be measured for voltage drops accross the relay contacts. Marginal voltages should be at least ± 7%.

THERMAL CUTOUT

Thermal cutout should take place between 33 and 37°, and adjusted with the three potentiometers on card 288 (E7).

Rialto, 31st March, 1967
FJ/KD

Adjustment of Core Store Strobe

~~R3-3000~~ [GIER]

The measuring is made in one pos. in ~~R~~ [LI] reg. card ~~1004~~ [1024] to which "1" is read continously from the core store.

Use probe with ground connected on pin ~~15~~ [~~serial IV + V pin 1N~~, serial VI pin 15]

Trig: ~~R...~~ [~~serial IV+V: R12 B1-31-8~~ 6, serial VI B1-31-~~31~~ 30 (1006A-14)]
Ext. neg.

Time: 0,2 uS

Chopped

A: 0,5V/cm
B: 2 V/cm
C: 2 V/cm

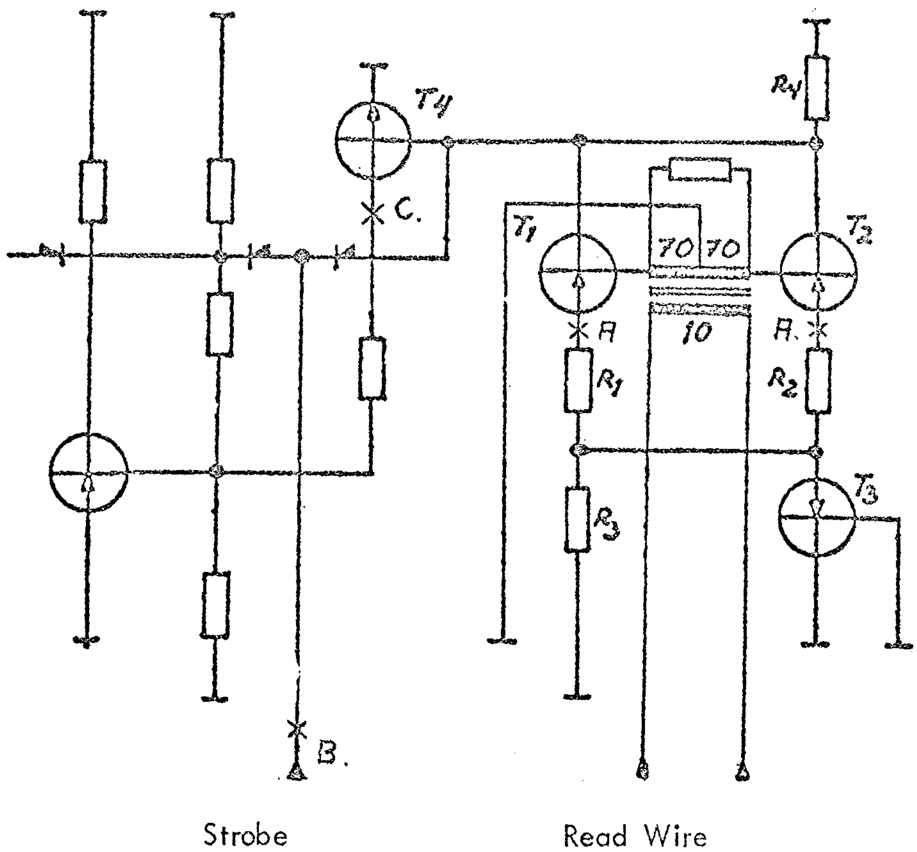


Fig. 1.

Fig. 2 shows the signals obtained in point A-B-C, on Fig. 1.

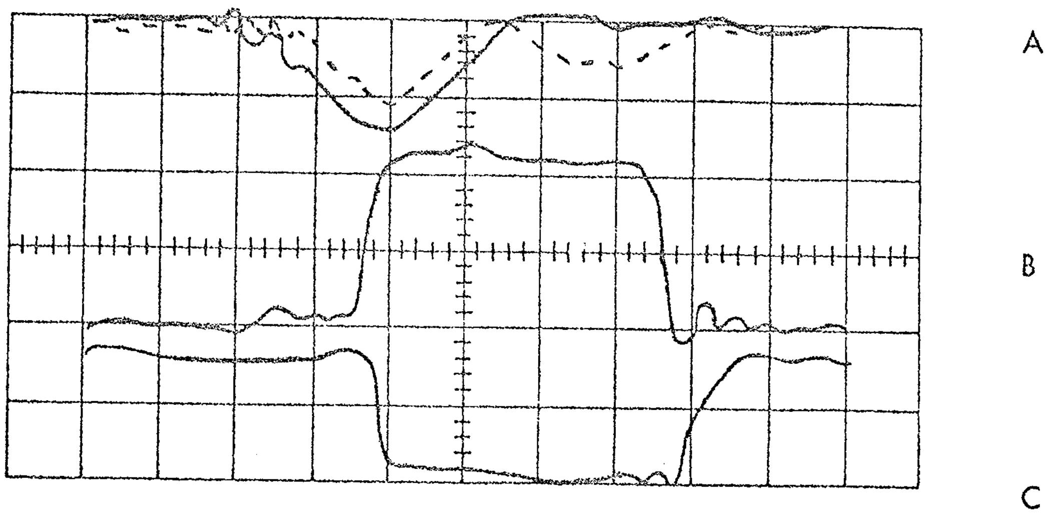


Fig. 2.

If ~~GE~~ [OT] is blocked, only one of the two read-signals (A) will be present.

If it is the dotted signal, then change to the other point A.

Adjust the leading edge of the strobe (B) to be in the middle of the read pulse (A) as shown on fig. 2.

Check that the trailing edge of the strobe (B) is coming before the trailing edge of (C). If not, the strobe is too long and adjustment is necessary.

The strobe must be approximately ~~0,75 uS~~ [1 uS] long.

[Testprogram no. 1.Topsøes test of the drum.
The program writes pseudo- random numbers on the tracks 1-319(the same number on all tracks) and compares the number that has been read with the written number.After each comparison for all the tracks is typed ok on the typewriter. By errors is typed track number,word number, the written word and the word that has been read.Bit 40 and 41 do not contain random numbers. KA=1 effects simultaneous computation by writing, KB=1 effects simultaneous computation by reading.Output on the typewriter can be removed by setting by=0 after the testprogram is read in.First instruction to be executed is zqLKB.
The drum parity check should be removed during run by the switch in GIER.]

```
i=41
[  41] zqLKB                        ;stop if KB=1
[  42] vy  16                       ;choice of typewriter
[  43] pa r8 t0                     ;choice of start track
[  44] pa r3 t-305                  ;choice of start address for random  numbers
[  45] hs r31                       ;jump to sequ. for random  numbers
[  46] tk 1 ,it 1                   ;shift
[  47] gr -305,hs r29               ;store random  numbers from 720 and jump
[  48] tk -30,ac (r-1)              ;shift and add
[  49] it(r-2),bs -265              ;is repeated 40-
[  50] hh r-5                       ;times
[  51] vk 0 t1                      ;choice of track +
[  52] sk -304                      ;write track
[  53] hv r5 NKA                    ;jump if KA=0
[  54] pa r2 t50                    ;put in 50 as counting number
[  55] hs r21 t29                   ;compute 50-
[  56] bt 50 t-1                    ;random  numbers simultaneously-
[  57] hv r-2                       ;with writing
[  58] vk(r-7),lk -504              ;choose track and read until 520
[  59] hv r5 NKB                    ;jump if KB=0
[  60] pa r2 t50                    ;place 50
[  61] hs r15                       ;compute 50-
[  62] bt 50 t-1                    ;random  numbers simultaneously-
[  63] hv r-2                       ;with reading
[  64] pa r3 t-305                  ;choice of start address for random  numbers
[  65] pa r3 t-505                  ;choice of start address for read numbers
[  66] vk (r-15)                    ;wait for the drum
[  67] arn -305 t1                  ;take the written
[  68] sr -505 t1                   ;subtract the read
[  69] gr r15,arn r15               ;store the difference and fetch it again
[  70] hv r15 NZ                    ;jump to typeout if not zero
[  71] it (r-3),bs -465             ;this is repeated-
[  72] hv r-5                       ;40 times
[  73] it (r-22),bs 319             ;if track number < 319
[  74] hv r-23                      ;jump back
[  75] hv r42                       ;else jump to typeout of ok
[  76] pm r7,mln r5                 ;RAND-1,subroutine for random  numbers
[  77] tk 8,gm r6
[  78] ar r5
[  79] sr r5 LO
[  80] gr r3,hr s1                  ;jump back
[  81] gtn p,dln r434               ;constant
[  82] udn (p511),gc -1             ;constant
[  83] sn p206 X t-228              ;constant
[  84] qq
[  85] sy 64,ud r39                 ;type CR and count down in 120
```

```
[  86] arn(r-35) D              ;fetch track number
[  87] hs r17                   ;jump to decimal typeout
[  88] qq
[  89] arn(r-21) D              ;fetch word number relatively


[  90] sr -504 D                ;find word number
[  91] hs r13                   ;jump to decimal typeout
[  92] qq
[  93] sy 64                    ;type CR
[  94] arn(r-27),tk 1           ;fetch the written word and-
[  95] sy 1 V LT                ;write-
[  96] sy                       ;it-
[  97] hh r-3 NZ                ;until the rest is only o-es
[  98] sy 64                    ;write CR
[  99] arn(r-31),tk 1           ;fetch the read word and-
[ 100] sy 1V LT                 ;write it-
[ 101] sy                       ;until the rest is only o-es
[ 102] hh r-3 NZ                ;
[ 103] hvr-32                   ;jump to repeat
[ 104] ck 10,tk 30              ;decimal typeout
[ 105] ck -10,pt r9
[ 106] dk r9 X
[ 107] pp 4,mln r9
[ 108] pp p-1,tk 20
[ 109] ar r5 V LZ
[ 110] pt r4 t16
[ 111] gt r , sy
[ 112] bs p510,ud r-2
[ 113] bs p , hh r-6
[ 114] hr s1,qq 16              ;jump back
[ 115] qq9  t-241
[ 116] qq  IZA
[ 117] sy 38 ,sy 34             ;type ok
[ 118] sy ,sy                   ;type two spaces
[ 119] sy ,sy                   ;type two spaces
[ 120] bt 12 t-1                ;up until 12 times
[ 121] hv 43                    ;jump to repeat
[ 122] pa r-2 t12               ;else place 12 as counting number
[ 123] sy 64 ,hv 43             ;write CR and jump to repeat
[ 124] pa r-4 t-1               ;count down to second to the last
e41
```

[Testprogram no. 2, typeout of bit-configuration or bit-pattern.Set the TYPEWRITER to the shortest distance between the lines.
Program is stored from location 41 to 89.The first instruction to be executed is zq LKB.The program will stop after 20 lines have been typed if KB=1.The typeout will be repeated by pressing START-button.]

```
i=41
[  41] zq LKB                   ;stop if KB=1
[  42] vy16 ,hs 50              ;choice of typewriter and jump
[  43] qq 70 t1                 ;constant and counter
[  44] bt 19 t-1                ;is performed-
[  45] hh r-3                   ;20 times
[  46] zq  LKB                  ;stop if KB=1
[  47] pa r-3 t19               ;set number of words
[  48] pa r-5 t70               ;set start address
[  49] hh r-7                   ;go to repeat
[  50] arn(s1) IPC              ;typeoutprogram.Fetch a word
[  51] sy 64 , sy 60            ;type CR and upper case
[  52] sy 6, tk 1               ;type [ and shift
[  53] sy 57 V LT               ;type I if sign is-
[  54] sy                       ;else type space
[  55] bt 39 t-1                ;is performed
[  56] hh r-4                   ;40 times
[  57] pa r-2 t39               ;set number of bits
[  58] sy 57 V LPA              ;type I if A-mark
[  59] sy                       ;else type space
[  60] sy 57 V LPB              ;type I if B-mark
[  61] sy                       ;else type space
[  62] sy 7,hr s1               ;type ] and jump back
[  63] qq                       ;empty
[  64] qq
[  65] qq
[  66] qq
[  67] qq
[  68] qq
[  69] qq
[  70] qq s1  IB t1             ;1 word in bitpattern
[  71] qq p3 IC t3
[  72] qq (p7) IKC t7
[  73] qqn (p15) IOC t15
[  74] zqn (p31) IRC t31
[  75] srn (p63) MRC t63
[  76] scn (p127) LRC t127
[  77] nkn (p255) D LRC t255
[  78] ppn (p511) VD LRC t511
[  79] udn (p-1) XVD LRC t-1
[  80] udn (p-1) XVD LRC t-1
[  81] udn (r-2) XVD LRA t-2
[  82] udn (-4) XVD LR t-4
[  83] udn -8 XVD LQ t-8
[  84] ud -16 XVD LT t-16
[  85] zl -32 XVD L t-32
[  86] hh -64 XVD N t-64
[  87] hv -128 XVD t-128
[  88] pc -256 XV t-256
[  89] pa -512 X t-512          ;last word in bitpattern
e41
```

[Testprogram no. 3.Typeout of track no. 0 in bit-pattern. Set the TYPEWRITER to double distance between the lines.
The testprogram is stored in locations 41 to 63,it uses the locations 64 to 103 for storing. The first instruction to be performed is zq LKB.The run can be repeated by pressing the START-button.]

```
i=41
[  41] zq LKB                          ;stop if KB=1
[  42] vk 0,lk 64                      ;choose and read track no. 0
[  43] vy 16,vk 0                      ;choose typewriter and wait for the drum
[  44] sy 62,hs 51                     ;black ribbon and jump to typeoutprogram
[  45] qq 64 t1                        ;constant and counter
[  46] bt 39 t-1                       ;is performed-
[  47] hh r-3                          ;40 times
[  48] pa r-3 t64                      ;set start address
[  49] pa r-3 t39                      ;set number of words
[  50] zq 0,hv r-7                     ;stop and go to restart
[  51] arn (s1) IPC                    ;typeoutprogram.Fetch a word
[  52] sy 64,sy 60                     ;type CR and upper case
[  53] sy 6,tk 1                       ;type [ and shift
[  54] sy 57 V LT                      ;type I if sign is-
[  55] sy 4                            ;else type =
[  56] bt 39 t-1                       ;is performed-
[  57] hh r-4                          ;40 times
[  58] pa r-2  t39                     ;set number of bits
[  59] sy 57 V LPA                     ;type I if A-mark
[  60] sy 4                            ;else type =
[  61] sy 57 V LPB                     ;type I if B-mark
[  62] sy 4                            ;else type =
[  63] sy 7 ,hr s1                     ;type ] and jump back
[  64] qq                              ;empty
e41
```

[Testprogram no. 4. Test of the fast memory or core-store. The content of M is stored in a location and is read back. If the read is equal to the written, the program will continue with the next location. The test is performed for the locations 60 - 1022. If KB=1 the program will stop and a new content can be placed in M. Position 40 and 41 in a location are not included in the test. By errors <f> is typed on the typewriter every time a content of a location is not hit right. If KA=1 GIER will stop while the number of the location that was hit wrong is placed in the in-register, and the difference between the read and the written is placed in the R-register. By restart or if KA=0 the program will go on testing the next location. The first instruction is zq LKB.]

```
i=41

[41] zq 0  LKB                  ;stop if KB=1
[42] gm 43 V                    ;store M in location no. 43
[43] qq 0                       ;empty
[44] gm 59 M t1                 ;store M in running location
[45] arn 43                     ;add content of location no. 43
[46] sr (44)                    ;subtract running location
[47] hv 52 NZ                   ;jump if R≠0
[48] arn 44                     ;add content of location no. 44
[49] ca 1022                    ;if number of running location is 1022
[50] pa 44 t59                  ;set 59 as address in location no. 44
[51] hv 41                      ;go to restart
[52] vy 16, sy 54               ;choose typewriter and type f
[53] pi (44)                    ;place no. of location in in-register
[54] zq 0 LKA                   ;stop if KA=1
[55] bt 40 t-1                  ;until 40 times
[56] hv 48                      ;jump
[57] pa 55 t40                  ;else place 40 as address in location 55
[58] sy 64 , hv 48              ;type CR and jump
[59] qq 0                       ;empty

e41
```

[Testprogram no. 5. Test of track no. 0. Help < 3
The program reads drum track no. 0 to the locations 128-167 in the core store and compares for each location with the correct content of track no. 0 , that is read in to the locations 70-109 after the program. If there is no error in track no. 0 the message ok will be typed. If there is an error in one or more locations, the program will stop after having typed -i- for errors in positions 0-39 and -m- for errors in the mark-positions. The content of the wrong location can be observed in the R-register and the address of the wrong location in the s-register (read modulo 128). In the M-register is -by errors in pos. 0.39 - placed the difference from the subtraction and - by errors in the mark-bits - the correct mark-bits in position 8 and 9.]

```
i=41

[41] zq  LKB
[42] vy 16 , sy 58                ;the typewriter in lower case
[43] zq LKB
[44] vk  0, lk 128                ;read track 0 to loc. 128  and on
[45] vk ,pi                       ;wait for the drum
[46] arn 69 IRC +1                ;correct run cellcontent to R (markbits indic.)
[47] sr 127  +1                   ;subtract next variable location
[48] gi 66 , pp                   ;correct marks to location no. 66
[49] hv 60 NZ                     ;jump if R ≠ 0
[50] arn (47) IRC                 ;read marks indic.
[51] arn 66 IK                    ;correct marks to R, read marks to p
[52] ncp , hv 63                  ;jump if wrong marks
[53] arn 47,nc 167                ;typeout if 40 locations are tested
[54] hh 45                        ;or jump back
[55] sy 64                        ;type CR
[56] sy 38, sy 34                 ;type ok
[57] pa 46  +69                   ;replace address number
[58] pa 47  +127                  ;replace address number
[59] hv 43
[60] sy 57  X                     ;type -i- ,difference to M
[61] arn (47) , ps(47)            ;wrong cellcontent to R,address to s
[62] zq  ,hv 50
[63] sy 36  X                     ;type -m- ,correct marks to M pos. 8 and 9
[64] arn(47), ps(47)              ;wrong cellcontent to R,address to s
[65] zq , hv 53
[66] qq                           ;location used for storing during run
```

[From location 70 to 109 is now placed the correct content of track no. 0. In this version it is assumed , that the HP-button is blocked by position 0 in the by-register. For a GIER, where the HP-button is blocked by pos. 3 in the by-register, the program can be used, if you before the run change the right half-word instructions in loc. 72 and 103 to vy r79 and vy 80]

```
i=70
[70]  qq
[71]  it 1,pa 10
[72]  gk 1, vy r-497          ;gk 1,vy r79 for HP blocked by pos. 3 in by-reg.
[73]  gi 2  IPC
[74]  gm 3  MPC
[75]  vk 32  IOB t-1
[76]  gr 4  MOB
[77]  tl -39 , pm 24
[78]  gr 7, tln -19
[79]  arn 2, cm -1
[80]  pmfn r  IRB
[81]  pi  66  IZA t-511
[82]  hh  17  NZA
[83]  gp  8 , pp  38
[84]  vk  319 t-1
[85]  sk -24  t-40
[86]  bt  23  t-1
[87]  hv  14,  pp  294
[88]  gs  6 , gin  9
[89]  vk  25 , lk -64
[90]  vk  p , lk -73
[91]  vk(5) ,lk -124
[92]  ps  41, ud  5
[93]  ps  s-1,  ar s-125
[94]  bs  s-1,hv r-1
[95]  bs (5)  IOB t-1
[96]  pp  () , hv 21
[97]  sy  64 V NZ
[98]  arn -25, hv -29
[99]  sy  29, sy  60
[100] sy  54, sy 53
[101] sy  33, sy  35
[102] gr -512  MOB
[103] ly 33, vy -496          ;ly 33,vy 80 for HP blocked by pos. 3 in by-reg.
[104] pmn  64 XD IZA
[105] tl  -7 ,ly r1
[106] pi   LZA t508
[107] xr  X  IZB
[108] hv  35  LZB
[109] gr  41  MRC t-1
e41
```

[Testprogram no. 6. Test of the core-store including marks.
The program examines the whole core-store exept for the locations that are occupied by the program itself.
At first zeroes are send to a location and the answer is checked, then ones are send to the same location and the answer is checked.

If stop in location 44 (r1=45): R0-39 $\neq$ 0, existing ones are wrong.

If stop in location 46 (r1=47): R40-41 $\neq$ 0, existing ones are wrong.

*) If stop in location 50 (r1=51): R0-39 $\neq$ 0, to position(s), containing a one and having a zero on the right side, a zero has been send from the store instead of a one.

If stop in location 52 (r1=53): R=40.41 $\neq$ 1.1, existing zeroes are wrong.

With LKB=1 the program will stop after having examined the core store from location 58 to 1023 and further on from location 0 to 40. In the indicator, the address of the location that is tested, can be observed.]

```
i=41

[41] zq LKB
[42] grn 57  M +1          ;zero to variable location
[43] arn(42) ,pi (42)
[44] zq NZ                 ;stop if R0-39 ≠ 0
[45] qq  V NC
[46] zq                    ;stop if R40.41 ≠ 0.0
[47] srn 57                ;constant is subtracted
[48] gr (42) MC            ;ones to variable location
[49] arn 57 , ar (42)      ;constant to R,content of location is added
[50] zq NZ                 ;stop if R0-39 ≠ 0
[51] qq  V LC
[52] zq                    ;stop if R40.41 ≠ 1.1
[53] arn 42 ,nc 40
[54] hv 42                 ;examine the next (variable) location
[55] pa 42 +57             ;replace the address 57 in location 42
[56] hv 41                 ;restart with location no. 58
[57] qq IB                 ;constant( 1 bit in position 39)

e41
```

Fejl

*) 11111110000

[Testprogram no. 7. Topsøes test of the floating point operations: AR F, SR F, MK F and DK F.
The testprogram operates in 6000 cycles. In each cycle two random, floating point numbers, a and b, are generated by means of the subroutines RAND-1 and RAND-2. The four floating point operations are then carried out on the numbers a and b, and the four results are added(as fixed points numbers) to four sum cells.
After 6000 cycles a line is printed on the typewriter, containing the number 6000 and the four sum cells in octal notation. The four sum cells are then cleared and 6000 new cycles are calculated, etc. If KB=1 the program will stop after 6000 cycles, and can be repeated by pressing the NORMAL START-button.

The correct output is (only the numbers):

```
6000  35271407753020  36242706607000  66043725657530  15577777733744
6000  35271407753020  36242706607000  66043725657530  15577777733744
etc.
test of:   add.            sub.            mult.           div.
```

Calculation of 6000 cycles takes about 35 sec. The value of 6000 is stored in cell 114 as an integer in pos. 39. It may be changed if required.
If KA is set to 1, output is obtained after each cycle.

The program is stored from cell 41 to 136.he first instruction to be executed is zq LKB.]

i=41

```
[ 41]  zq LKB                      ;stop if KB=1
[ 42]  vy 16,hv r4                 ;typewriter output,go to 46
[ 43]  qq 0
[ 44]  qq 0
[ 45]  zq LKB                      ;stop if KB=1
[ 46]  grn r71 [117]               ;sum:=0
[ 47]  grn r71 [118]               ;sum:=0
[ 48]  grn r71 [119]               ;sum:=0
[ 49]  grn r71 [120]               ;sum:=0
[ 50]  hv r19                      ;go to 69
[ 51]  qq 0
[ 52]  qq 0
[ 53]  qq IZA                      ;parameter
[ 54]  gcn s9   t320               ;parameter
[ 55]  pi       t-65               ;from 55 to 66 is placed -
[ 56]  arn r-2,gr r-13             ;a subroutine for printing -
[ 57]  dln r-14,tk 20              ;out the counter in location -
[ 58]  pi  64  NZ t-65             ;115 in decimal notation.
[ 59]  hv  r3   NZ
[ 60]  hv  r2   NTB
[ 61]  sy  16,hv  r2
[ 62]  gt  r ,sy
[ 63]  gm  r-11,pm  r-20
[ 64]  dln  r-11,gr  r-21
[ 65]  hr s2   LZ
[ 66]  pm  r-14,hv  r-9
[ 67]  qq         t256             ;parameter
[ 68]  qq         IB               ;parameter
[ 69]  grn  r-25                   ;zeroes to cell 44
[ 70]  arn  r39,gr  r65            ;mge start-random from 109 to 135
[ 71]  grn  r44                    ;counter:=0
[ 72]  pp  2,pp  p-1               ;p:=2 , p:=p-1
[ 73]  grn  p121,hs  r51           ;cell:=0 , go to RAND-2
[ 74]  qq  20                      ;parameter
```

```
[ 75]  sr   10 D                    ;-10
[ 76]  ga   p121,hs  r52            ;set exp. ,go to RAND-1
[ 77]  tk   2     ITA               ;set sign
[ 78]  ck   -6,tl  -6               ;Roo:=0
[ 79]  ac   p121,arn  r-12          ;store , fetch 1
[ 80]  tk   1    LTA                ;if neg. then -2
[ 81]  ac   p121                    ;add to cell
[ 82]  bs   p,hh  r-10              ;repeat
[ 83]  pp   4,pp  p-1               ;p:=4 , p:=p-1
[ 84]  arfn  r37,udf  p110          ;fetch b , execute
[ 85]  grf  r38                     ;store in 123
[ 86]  arn  r37,ac  p117            ;add to cell
[ 87]  bs   p,hh  r-4               ;repeat
[ 88]  hsn  r5 X LKA t52            ;check output
[ 89]  arn  r-21,ar  r26            ;count
[ 90]  gr   r25,sr  r24             ;- limit
[ 91]  hv   r-19   LT               ;repeat
[ 92]  psn  r43                     ;final output
[ 93]  sy   64,arn  r22             ;CAR RET,counter to R-reg.
[ 94]  hs   r-39 X  t59             ;print counter
[ 95]  qq   257  t-144              ;parameters
[ 96]  sy   ,sy                     ;2 SPACES
[ 97]  pp   4,pp  p-1               ;p:=4 , p:=p-1
[ 98]  arn  p117,tl  -10            ;fetch number , shift
[ 99]  ga   r17,sr  r17             ;delete bits 0-9
[100]  tl   3,ca                    ;shift , if zero
[101]  sy   16,hv  r2               ;then print zero
[102]  ga   r14,sy (r14)            ;store and print
[103]  bt   13  t-1                 ;repeat 13 times
[104]  hv   r-5
[105]  pan  r-2  X  t13             ;reset address in bt-instruction
[106]  sy   ,sy                     ;2 SPACES
[107]  bs   p,hh  r-10              ;repeat
[108]  hr   s1                      ;exit ( to 136)
[109]  bs   p104  V  t-333          ;start random
[110]  dkf  r11                     ;/b
[111]  mkf  r11                     ;×a
[112]  srf  r10                     ;-a
[113]  arf  r9                      ;+a
[114]  qq   (s)   XV  LT            ;6000 = limit
[115]  qq                           ;counter
[116]  qq                           ;storage of address
[117]  qq                           ;storage of div.
[118]  qq                           ;storage of mult.
[119]  qq                           ;storage of subtr.
[120]  qq                           ;storage of add.
[121]  qq                           ;storage of b
[122]  qq                           ;storage of a
[123]  qq                           ;storage of result
[124]  hs   r4  t44                 ;RAND-2
[125]  xr   ,mkn  s1
[126]  mb   511 D
[127]  hr   s2
[128]  pm   r7,mln  r5              ;RAND-1
[129]  tk   8,gm  r6
[130]  ar   r5
[131]  sr   r3  LO
[132]  gr   r3,hr  s1
[133]  gtn  p,dln  r434
[134]  udn (p511),pc  -1
[135]  qq                           ;age of start random
[136]  hv   45                      ;go to 6000 new cycles
e41
```

[Testprogram no. 8. Test of drum track transfer time.
The time for execution of an LK instruction is tested by the program. If KA is set to 1, the transfer time for all tracks is printed out. If KA=0 there will only be output for tracks with a transfer time different from 20 ms. The output is in binary notation for the transfer times as well as for the track numbers.

After the end of a test run (output <slut> on the typewriter), the test can be repeated by pressing the NORMAL START-button. If the qq instruction in location 57 is changed to a zq instruction, the actual transfer time can after stop in location 57 be observed in the R-register in microseconds with unit in pos. 19.
First instruction to be executed is zq LKB in location 41.]

```
i=41
[41]  zq LKB              ;stop if KB=1
[42]  vy 16,sy 64         ;select typewriter,CR
[43]  sy 58,sy 36         ;lower case,m
[44]  sy 18               ;s
[45]  bt 10 t-1           ;write 10 SPACE
[46]  sy  ,hv 45
[47]  sy 19,sy41          ;t,r
[48]  sy 49,sy 51         ;a,c
[49]  sy34,sy 64          ;k,CR
[50]  bt 320 t-1          ;select -
[51]  vk  -1  V  t1       ;- tracks 0-319
[52]  hv 75               ;go to 75 if track no. =319
[53]  lkn -512            ;read track, zeroes to R
[54]  hk 57               ;if transfer finished then go to 57 -
[55]  ar 74               ;else add 113 microseconds
[56]  hv 54               ;and go to 54
[57]  qq                  ;empty
[58]  nc 20 NKA           ;output for all tracks if KA=1 -
[59]  ps 66 V             ;- else only output for tracks -
[60]  hv 50               ; - with transfer time ≠ 20 ms
[61]  tk 1                ;shift 1 position to the left
[62]  sy 1  V LT          ;print 1 if sign
[63]  sy 38               ;else print o
[64]  bt 9 t-1            ;and repeat 9 times -
[65]  hv 61               ;- from 61
[66]  hv s1
[67]  sy  ,sy             ;2 SPACE
[68]  pa 64 t9            ;reset address in loc. 64
[69]  arn (51) D          ;track no. to R
[70]  hs 61               ;print track no.
[71]  pa 64 t9            ;reset address in loc. 64
[72]  sy  64              ;CR
[73]  hv  50              ;go to new track
[74]  qq  t113            ;number of microseconds
[75]  sy  18              ;s
[76]  sy  35,sy  20       ;l,u
[77]  sy  19,sy  64       ;t,CR
[78]  zq                  ;stop
[79]  pa  45  t10         ;reset loc. 45
[80]  pa  50  t320        ;reset loc. 50
[81]  pa  51t-1           ;reset loc. 51
[82]  hv  41              ;go to start
e41
```

[Testprogram t10 (ferrittest)

The program test reading and writing in cells 512-1023 in the fast memory. If a cell in this interval is mistaken for another cell in the same interval there will be no errorreaction , because the program use the same bitpattern in all cells during one testcycle. The program is stored from cell 41 to 131.

INPUT OF PROGRAM cells 0-3 for help 3

The program is published in a condensed version (a B-tape) to be read into the machine by the basic inputprogram on channel 0, cells 34-39. After the input a sumcheck of the program is performed. If this check is ok. the program writes <CR,t 10 > on the typewriter with black ribbon, otherwise the programname will be typed in red, and the program stops in cell 49.

TESTDIGITS

After reading in and sumcheck the program will stop in cell 51 if KB=1. During this stop the registers R and In contains zeroes. If no bits are inserted the program itself will generate the testdigits for the run. If bits are inserted in R or In these bits will serve as testdigits during the run. In In only RA and RB gives sense.

BUILD IN TESTDIGITS

When the build in testdigits are used , 42 consecutive bits is taken from a group of bits containing:

1,1,1,1,....,1,0,0,0,0,....,0,1,1,1,1,....,1
(42 bits) (42 bits) (41 bits)

This means that each cell is automatically tested with 84 different (but known) bitpatterns.

OPERATORS TESTDIGITS

If the operator choose the testdigits each cell will be tested 81 times with the choosen bitcombination. The operator must insert the bits in R0-39 and the marks in In[RA,RB].

ERROR REACTIONS

During the running of the program , the normal condition of KA and KB is KA=KB=0. In this case there will be no error-output before one complete run is terminated. A complete run means writing and reading in cells 512-1023 of either the 84 generated bitpatterns or 81 times with the operators bits.

NO ERROR: If no error is registrated the run will terminate with the typed message <CR,ok> and a hoot at 1000 c/s in 5 seconds.

ERROR: If an error is registrated the run will terminate with the typed message <CR,-> and the frequency of the hoot will alternate between 950 c/s and 1100 c/s.

KA=1 will cause the program to stop when an error is detected in the bits 0-39 or the marks in the cell in question. There is two possible stoppoints in the program:

1) Stop with r1=122 [0001111010] indicates error in bits 0-39. The testbits used will be found in M. Bits in R set to 1 are errors. Depressing the START-button two times while the STOP-button is depressed will transfer the adress of the cell to p and the cellcontent to R0-39. Depressing START will continue the test.
2) Stop with r1=125 [0001111101] indicates error in the marks. The testmarks is stored in R8-9 and the marks of the cell in In[RA,RB]. The adress of the cell is transferred to p. Depressing START will continue the test.

Setting KB=1 when the machine is stopped in an error , and depressing START , will cause cycling in a loop as long as KB=1. In this loop th content of M0-39 and In[RA,RB] is stored in the cell , and the content of the cell is read to R0-39 and In[QA,QB].]

```
[Test of the fast memory,cell 512-1023]
i=   41
[  41] vy    16           ,psn  132
[  42] ps    s-1          ,ar   s
[  43] bs    s-41         ,hv   r-1 [42]   ;form checksum of the program
[  44] sy    62           ,tk   1
[  45] sy    29             NZ             ;if errorsum then redshift
[  46] sy    64           ,sy   19
[  47] sy                 ,sy   1
[  48] sy    16           ,sy   62         ;outtext(outcr,⊰<t 10⊱,blackshift)
[  49] zq                   NZ             ;if errorsum then stop
[  50] pin                                 ;R:=In:=0
[  51] zq                   LKB            ;if KB then stop for manual testdigits
[  52] gr    r57 [109]      M              ;controlcell 40,41 := 0,0
[  53] pa    r35 [88]             t1       ;manualdigits:=true
[  54] gi    r2 [56]      V  LZ            ;if R=0 then c56adr:=In / goto c56
[  55] pa    r18 [73]     ,hv   r36 [91]   ;error:=false / goto operators testdigits
[  56] nc                 ,hv   r-1 [55]   ;if In≠0 then goto c55
[  57] pa    r31 [88]     ,pa   r16 [73]   ;manualdigits:=false / error:=false
[  58] pm     D                            ;M:=0
[  59] pi                 ,hs   101        ;In:=0 / test
[  60] pi    1            ,hs   101        ;In:=1 / test
[  61] pi    3            ,hs   101        ;In:=3 / test
[  62] pm    r37 [99]     ,hs   101        ;M 0-39 := all 1 / test
[  63] xrn                ,cl   -1         ;R:=M×2↑(-1)
[  64] hh    r-2 [62]     X  NZ            ;if M≠0 then begin M:=R;goto c62 end
[  65] pm    r34 [99]     ,pi   2          ;M 0-39 := all 1 / In:=2
[  66] hs    101                           ;test
[  67] pi                 ,hs   101        ;In:=0 / test
[  68] xr                 ,tk   1          ;R:=M×2
[  69] pm    r30 [99]     ,cm   r31 [100]  ;if R≠-1 then begin M:=R;goto c71 end
[  70] hh    r-3 [67]     X                ;else goto c67
[  71] gr    r38 [109]    XV MRC           ;controlcell 40,41 := 1,1 / M:=R
[  72] hs    101                           ;test
[  73] ps                 ,sy   64         ;s:=error / outcr
[  74] can   s            ,hv   r2 [76]    ;if ¬,error then goto c76
[  75] sy    32           ,hv   r2 [77]    ;else writetext(⊰<->⊱) / goto c77
[  76] sy    38           ,sy   34         ;writetext(⊰<ok⊱)
[  77] pa    r9 [86]              t9
[  78] pa    r5 [83]              t511     ;initialize hootduration
[  79] pa    r2 [81]              t7       ;initialize frequency-cycle
[  80] ar    s128         D                ;Radr := (if error then 8 else 0)+128+Radr
[  81] bt    7                    t-1      ;for i:=7 step -1 until 1 do
[  82] hv    r-2 [80]                      ;goto c80
[  83] bt    511                  t-1      ;for j:=511 step -1 until 1 do
[  84] hv    r-5 [79]                      ;goto c79
[  85] ns    s            ,ps   s          ;s:=-s
[  86] bt    9                    t-1      ;for k:=9 step -1 until 1 do
[  87] hv    r-9 [78]                      ;goto  c78
[  88] bs                                  ;if manualdigits then
[  89] hv    r-38 [51]    X                ;goto newtest(Operatorsdigits)
[  90] hv    r-40 [50]                     ;else goto newtest(buildindigits)
[  91] pm    r8 [99]      ,cm   r9 [100]   ;Operatorsdigits:
[  92] hv    r2 [94]                       ;if R≠-1 then goto c94
[  93] gr    r16 [109]      MRC            ;controllcell 0-39 := R ;40,41:=RA,RB
[  94] pa    r2 [96]      X       t80      ;M:=R / for i:=1 step 1 until 81 do
[  95] hs    101                           ;test
```

```
[  96] bt                                 t-1
[  97] hv    r-2 [95]
[  98] hv    r-25 [73]                                ;test finished
[  99] udn (p-1)          XVDLRC t-1                  ;constant 0-39 := all 1
[ 100] qq    -512                                     ;procedure test;begin
[ 101] pa    r3 [104]            t511                 ;entry to test
[ 102] pa    r1 [103]                                 ;for j:=1023 step -1 until 512 do
[ 103] gm                    MRC t-1                  ;cell j 0-39:= M cellj 40-41 :=RA,RB
[ 104] bt    511                 t-1
[ 105] hv    r-2 [103]
[ 106] pa    r12 [118]           t511                 ;for i:=1023 step -1 until 512 do begin
[ 107] pa    r7 [114]
[ 108] grn   r1 [109]     XV                          ;controlcell 0-39 := 0 / R:=testdigits
[ 109] qq
[ 110] sc    r-1 [109]    X                           ;controlcell:=-testdigits / M:=testdigits
[ 111] gi    r9 [120]                                 ;c120adr:=In
[ 112] pi                 ,arn  r-3 [109]             ;In:=0 / R:=-testdigits
[ 113] srn   r-4 [109]      LC                        ;if R=-1 then R:=-(-testdigits)
[ 114] ar                   IRC t-1                   ;R:=R+cell[i] / In[RA,RB]:=cell i 40,41
[ 115] hv    r6 [121]       NZ                        ;if R≠0 then goto errorincell
[ 116] gi    r1 [117]     ,arn  r4 [120]              ;c117adr := In / R:= old In
[ 117] nc                 ,hh   r6 [123]              ;if newmarks≠oldmarks then goto errorinmarks
[ 118] bt                        t-1                  ;one cell tested
[ 119] hv    r-7 [112]
[ 120] pi                 ,hr   s1                    ;In:=Original marks / end of procedure test;
[ 121] zq                   LKA                       ;errorincell: if errorincell∧KA then stop
[ 122] pp    (r-8)[114]   ,arn  p                     ;p:=adress of wrong cell / R:=wrong cell
[ 123] hv    r2 [125]     ,pp   (r-9)[114]            ;goto seterror / errorinmarks: p:=adress of wrong
[ 124] zq                   LKA                       ;if error in marks ∧KA then stop
[ 125] pa    r-52 [73]           t8                   ;seterror: error:=true
[ 126] pi    (r-6)[120]   ,hv   r3 [129]              ;In:=original marks
[ 127] gm    p              MRC                       ;testdigits to cell
[ 128] arn   p              IQC                       ;cell to R
[ 129] hv    r-2 [127]      LKB                       ;if KB then cycle in 127-128
[ 130] pi    (r-10)[120]  ,hv   r-12 [118]            ;In:=Original marks / continue the test
[ 131] gmn   -319         X  LP  t488                 ;checksum of program
s
```

[Testprogram t11 (ferrittest)

The program test reading and writing in cells 0-511 in the fast memory. If a cell in this interval is mistaken for another cell in the same interval there will be no errorreaction , because the program use the same bitpattern in all cells during one testcycle.The program is stored from cell 513 to 603 .

INPUT OF PROGRAM

The program is published in a condensed version (a B-tape) to be read into the machine by the basic inputprogram on channel 0,cells 34-39.After the input a sumcheck of the program is performed.If this check is ok. the program writes <CR,t 10 > on the typewriter with black ribbon, otherwise the programname will be typed in red,and the program stops in cell 521.

TESTDIGITS

After reading in and sumcheck the program will stop in cell 523 if KB=1.Durin this stop the registers R and In contains zeroes.If no bits are inserted the program itself will generate the testdigits for the run.If bits are inserted in R or In these bits will serve as testdigits during the run.In In only RA and RB gives sense.

BUILD IN TESTDIGITS

When the build in testdigits are used , 42 consecutive bits is taken from a group of bits containing:

1,1,1,1,....,1,0,0,0,0,....,0,1,1,1,1,....,1

42 bits 42 bits 41 bits

This means that each cell is automatically tested with 84 different (but known) bitpatterns.

OPERATORS TESTDIGITS

If the operator choose the testdigits each cell will be tested 81 times with the choosen bitcombination.The operator must insert the bits in R0-39 and the marks in In[RA,RB].

ERROR REACTIONS

During the running of the program , the normal condition of KA and KB is KA=KB=0.In this case there will be no error-output before one complete run is terminated.A complete run means writing and reading in cells 0-511 of either the 84 generated bitpatterns or 81 times with the operators bits.

NO ERROR: If no error is registrated the run will terminate with the typed message <CR,ok> and a hoot at 1000 c/s in 5 seconds.

ERROR: If an error is registrated the run will terminate with the typed message <CR,-> and the frequency of the hoot will alternate between 950 c/s and 1100 c/s.

KA=1 will cause the program to stop when an error is detected in the bits 0-39 or the marks in the cell in question.There is two possible stoppoints in the program:

1) Stop with r1=594[1001010010] indicates error in bits 0-39. The testbits used will be found in M.Bits in R set to 1 are errors.Depressing the START-button two times while the STOP-button is depressed will transfer the adress of the cell to p and the cellcontent to R0-39.Depressing START will continue the test.
2) Stop with r1=597[1001010101] indicates error in the marks. The testmarks is stored in R8-9 and the marks of the cell in In[RA,RB].The adress of the cell is transferred to p. Depressing START will continue the test.

Setting KB=1 when the machine is stopped in an error , and depressing START , will cause cycling in a loop as long as KB=1.In this loop th content of M0-39 and In[RA,RB] is stored in the cell , and the content of the cell is read to R0-39 and In[QA,QB].]

```
[Test of the fast memory,cells 0-511]
i= -511
[-511] vy   16            ,psn  -420
[-510] ps   s-1           ,ar   s
[-509] bs   s511          ,hv   r-1 [-510]   ;form checksum of the program
[-508] sy   62            ,tk   1
[-507] sy   29               NZ              ;if errorsum then redshift
[-506] sy   64            ,sy   19
[-505] sy                 ,sy   1
[-504] sy   1             ,sy   62           ;typetext(CR,<<t 11>>,blackshift)
[-503] zq                    NZ              ;if errorsum then STOP
[-502] pin                                   ;R:=In:=0
[-501] zq                    LKB             ;if KB=1 then STOP for manual testdigits
[-500] gr   r57 [-443]       M               ;controlcell 40,41:= 0,0
[-499] pa   r35 [-464]          t1           ;manualdigits:=true
[-498] gi   r2 [-496]     V  LZ              ;if R=0 then c528adr:=In / goto c528
[-497] pa   r18 [-479]    ,hv   r36 [-461]   ;error:=false / goto operators testdigits
[-496] nc                 ,hv   r-1 [-497]   ;if In≠0 then goto c527
[-495] pa   r31 [-464]    ,pa   r16 [-479]   ;manualdigits:= false / error:= false
[-494] pm    D                               ;M:= 0
[-493] pi                 ,hs   -451         ;In:= 0 / test
[-492] pi   1             ,hs   -451         ;In:= 1 / test
[-491] pi   3             ,hs   -451         ;In:= 3 / test
[-490] pm   r37 [-453]    ,hs   -451         ;M0-39:= all 1 / test
[-489] xrn                ,cl   -1           ;R:= M×2↑(-1)
[-488] hh   r-2 [-490]    X  NZ              ;if M≠0 then begin M:=R;goto c534 end
[-487] pm   r34 [-453]    ,pi   2            ;M0-39:= all 1 / In:=2
[-486] hs   -451                             ;test
[-485] pi                 ,hs   -451         ;In:= 0 / test
[-484] xr                 ,tk   1            ;R:= M×2
[-483] pm   r30 [-453]    ,cm   r31 [-452]   ;if R≠-1 then begin M:=R;goto c543 end
[-482] hh   r-3 [-485]    X                  ;else goto c539
[-481] gr   r38 [-443]    XV MRC             ;controlcell 40,41:= 1,1 / M:=R
[-480] hs   -451                             ;test
[-479] ps                 ,sy   64           ;s:= error / typetext(CR)
[-478] can  s             ,hv   r2 [-476]    ;if -,error then goto c548
[-477] sy   32            ,hv   r2 [-475]    ;else typetext(<<->>) / goto c549
[-476] sy   38            ,sy   34           ;typetext(<<ok>>)
[-475] pa   r9 [-466]           t9
[-474] pa   r5 [-469]           t511         ;initialize hootduration
[-473] pa   r2 [-471]           t7           ;initialize frequencycycle
[-472] ar   s128          D                  ;Radr:= Radr+128+(if error then 8 else 1)
[-471] bt   7                   t-1          ;for i:= 7 step -1 until 1 do
[-470] hv   r-2 [-472]                       ;goto c552
[-469] bt   511                 t-1          ;for j:= 511 step -1 until 1 do
[-468] hv   r-5 [-473]                       ;goto c551
[-467] ns   s             ,ps   s            ;s:= -s
[-466] bt   9                   t-1          ;for k:= 9 step -1 until 1 do
[-465] hv   r-9 [-474]                       ;goto c550
[-464] bs                                    ;if manualdigits then
[-463] hv   r-38 [-501]   X                  ;newtest(operators testdigits)
[-462] hv   r-40 [-502]                      ;else newtest(buildin testdigits)
[-461] pm   r8 [-453]     ,cm   r9 [-452]    ;operators testdigits:
[-460] hv   r2 [-458]                        ;if R≠ -1 then goto c566
[-459] gr   r16 [-443]       MRC             ;controlcell0-39:= R , 40-41:=RA-RB
[-458] pa   r2 [-456]     X     t80          ;M:=R / for i:= 1 step 1 until 81 do
[-457] hs   -451                             ;test
[-456] bt                       t-1
[-455] hv   r-2 [-457]
[-454] hv   r-25 [-479]                      ;test finished
[-453] udn  (p-1)         XVDLRC t-1         ;constant0-39= all 1
```

```
[-452] qq   -512                                  ;procedure test;begin
[-451] pa   r3 [-448]            t511             ;entry to test
[-450] pa   r1 [-449]            t-512            ;for j:= 511 step -1 until 0 do
[-449] gm                    MRC t-1              ;cellj0-39:= M, 40-41:=RA,RB
[-448] bt   511                  t-1
[-447] hv   r-2 [-449]
[-446] pa   r12 [-434]           t511             ;for i:= 511 step -1 until 0 do begin
[-445] pa   r7 [-438]            t-512
[-444] grn  r1 [-443]   XV                        ;controlcell0-39:= 0 / R:=testdigits
[-443] qq
[-442] sc   r-1 [-443]  X                         ;controlcell:= -testdogits / M:= testdigits
[-441] gi   r9 [-432]                             ;c592adr:= In
[-440] pi               ,arn  r-3 [-443]          ;In:= 0 / R:=-testdigits
[-439] srn  r-4 [-443]   LC                       ;if R= -1 then R:=-(-testdigits)
[-438] ar                IRC t-1                  ;R:=R+cell i / In[RA,RB]:= cell i 40,41
[-437] hv   r6 [-431]    NZ                       ;if R‡ 0 then goto error in cell
[-436] gi   r1 [-435]   ,arn  r4 [-432]           ;c589adr:= In / Radr:= old·In
[-435] nc               ,hh   r6 [-429]           ;if newmarks‡ old marks then goto error in marks
[-434] bt                        t-1              ;one cell tested
[-433] hv   r-7 [-440]
[-432] pi               ,hr   s1                  ;In:= original marks / end of procedure test;
[-431] zq                LKA                      ;error in cell: if error∧KA=1 then STOP
[-430] pp   (r-8)[-438] ,arn  p                   ;p:=adress of error / R:=errorcell
[-429] hv   r2 [-427]   ,pp   (r-9)[-438]         ;goto set error / error in marks: p:=erroradress
[-428] zq                LKA                      ;if error∧KA=1 then STOP
[-427] pa   r-52 [-479]      t8                   ;set error: error:=true
[-426] pi   (r-6)[-432] ,hv   r3 [-423]           ;In:= original marks
[-425] gm   p            MRC                      ;send testdigits to cell
[-424] arn  p            IQC                      ;read cell·to R
[-423] hv   r-2 [-425]   LKB                      ;if KB=1 then cycle in cells 599-600
[-422] pi   (r-10)[-432] ,hv  r-12 [-434]         ;In:= original marks / continue with next cell
[-421] gmn  -228        X  LP  t-296              ;checksum of the program
s
```

Before start KA, KB are set to 0, 1. The test is supplied with a number of loops, so if any error occurs, KA is set to one, and the program will run in the loop, where the error appeared. All stops indicate errors. Cellnumber is found by subtraction of one from the content of r_1.

```
41   zq                LKB
42   grn   300
43   pi    -1
44   gi    300
45   arn   300
46   sr    -1   D
47   zq                NZ
48   hv    43          LKA    loop A, test of flip-flops for "ones"
49   pi
50   gi    300         MOC
51   arn   300
52   zq                NZ
53   hv    49          LKA    loop B, test of flip-flops for "zeroes"
54   pi    -1                 t-2 inhibit changing all except RB
55   zq                NRB
56   pi    -2                 t-3 inhibit changing all except RA
57   zq                NRA
58   hv    60          LRC  ⎫
59   zq                     ⎪
60   zq                LOA  ⎪
61   zq                LOB  ⎪
62   zq                LTA  ⎪
63   zq                LTB  ⎬  proving "L" indicator orders
64   zq                LPA  ⎪
65   zq                LPB  ⎪
66   zq                LQA  ⎪
67   zq                LQB  ⎭
68   gi    300 ,arn   300
69   sr    3    D
70   zq                NZ
```

```
 71   qq          MOC   R40-41 are set to zero
 72   ppn         IRB   dummy order , RB: = 0
 73   ppn         IRA   dummy order , RA: = 0
 74   zq          LRB
 75   zq          LRA
 76   qq          M     R40-41 are set to one
 77   ck    10    IRB   dummy order, RB: = 1
 78   ck    10    IRA   dummy order, RA: = 1
 79   zq          NRA
 80   zq          NRB
 81   hv    54    LKA   loop C, test of RA, RB
 82   pi    -4          t-5 inhibit changing all except QB
 83   zq          NQB
 84   pi    -8          t-9 inhibit changing all except QA
 85   zq          NQA
 86   hv    88    LQC ┐
 87   zq              │
 88   zq          LOA │
 89   zq          LOB │
 90   zq          LTA │
 91   zq          LTB ├ proving "L and N" indicator orders
 92   zq          LPA │
 93   zq          LPB │
 94   zq          NRA │
 95   zq          NRB ┘
 96   gi        , arn     300
 97   sr    15  D
 98   zq          NZ
 99   gmn   400   IQB   dummy order, QB: = 0
100   gmn   400   IQA   dummy order, QA: = 0
101   zq          LQB
102   zq          LQA
103   qq          M
104   tk    2     IQB   dummy order, QB: = 1
105   tk    2     IQA   dummy order, QA: = 1
106   zq          NQB
107   zq          NQA
108   hv    82    LKA   loop D, test of QA, QB
```

```
109  pi    -16          t-17 inhibit changing all except PB
110  zq          NPB
111  pi    -32          t-33 inhibit changing all except PA
112  zq          NPA
113  hv    115   LPC
114  zq
115  zq          LOA
116  zq          LOB
117  zq          LTA    proving "L" and "N" indicator orders
118  zq          LTB
119  zq          NQA
120  zq          NQB
121  zq          NRA
122  zq          NRB
123  gi    300
124  arn   300
125  sr    63  D
126  zq          NZ
127  gmn   400   IPB    dummy order, PB: = 0
128  gmn   400   IPA    dummy order, PA: = 0
129  zq          LPB
130  zq          LPA
131  qq          M
132  tl    4     IPB    dummy order, PB: = 1
133  tl    4     IPA    dummy order, PA: = 1
134  zq          NPB
135  zq          NPA
136  hv    109   LKA    loop E, test of PA and PB
137  pi    -64          t-65 inhibit changing all except TB
138  zq          NTB
139  pi    -128         t-129 inhibit changing all except TA
140  zq          NTA
141  hv    143   LTC
142  zq
```

```
143  zq            LOA  )
144  zq            LOB  |
145  zq            NTA  |
146  zq            NTB  |
147  zq            NPA  } proving "L" and "N" indicator orders
148  zq            NPB  |
149  zq            NQA  |
150  zq            NQB  |
151  zq            NRA  )
152  zq            NRB
153  gi   300
154  arn  300
155  sr   255  D
156  zq            NZ
157  qqn           ITB   TB: = 0
158  qqn           ITA   TA: = 0
159  zq            LTB
160  zq            LTA
161  arn  -1   D   ITB   TB: = 1
162  arn  -1   D   ITA   TA: = 1
163  zq            NTB
164  zq            NTA
165  hv   137      LKA   loop F, test of TA and TB
166  pi   -256           t-257 inhibit changing all except OB
167  zq            NOB
168  zq            NZB
169  pi   -512           t-511 inhibit changing all except OA
170  zq            NOA
171  zq            NZA
172  hv   174      LOC  )
173  zq                 |
174  hv   176      LZC  |
175  zq                 |
176  zq            NTA  |
177  zq            NTB  } proving "L" and "N" indicator orders
178  zq            NPA  |
179  zq            NPB  |
180  zq            NQA  |
181  zq            NQB  |
182  zq            NRA  |
183  zq            NRB  )
```

```
184  gi   300
185  arn  300
186  sr   -1    D
187  zq             NZ
188  arn            IOB   dummy order, OB: = 0
189  qqn            IOA   dummy order, OA: = 0
190  zq             LOB
191  zq             LOA
192  arn  -1    D
193  ar   -512  D   IOB                  OB: = 1
194  ar   -512  D   IOA                  OA: = 1
195  zq             NOB
196  zq             NOA
197  hv   166       LKA   loop G, test of OA, OB
198  pi   -1
199  pi                   t-1
200  hv   202       LZC ┐
201  zq                 │
202  hv   204       LOC │
203  zq                 │
204  hv   206       LTC │
205  zq                 ├ proving "L" indicator orders
206  hv   208       LPC │
207  zq                 │
208  hv   210       LQC │
209  zq                 │
210  hv   212       LRC ┘
211  zq
212  arn  211       IZB ┐
213  ar   211       IZA │
214  zq             LZB │
215  zq             LZA │
216  pmn            IZC │
217  zq             NZB │
218  zq             NZA ├ proving Z combinations
219  pin                │
220  qq             IZB │
221  ar   212           │
222  zq             NZB │
223  pin                │
224  qq             IZA │
225  ar   213           │
226  zq             NZA ┘
```

```
227  pi
228  hv  198    LKA   loop H, test of Z
229  hv  41
```

[Tromletest 4. This program writes random numbers on previous selected drum tracks, reads and compares the contents word by word incl. flag bits. Calculations may be performed simultaneously with the drum test by means of an adder test.

After the message ,klar, the typewriter is ready for input of 3 arbitrary numbers (each terminated by CR) intended for the production of the random test numbers.

The program has several adjustment variations. The p-register contains the track no. to be tested. The five last bits of the in-register have the following meaning:

KB=0 : Adder test simultaneously with the drum test.
KB=1 : Either adder test or drum test depending on when KB is set equal to 1.
KA=0 : No stop if adder error.
KA=1 : Stop if adder error.
The typewriter writes ,1, if adder test is ok, and ,3, if adder error.
RB=0 : No counting in the p-register. Test of the same track.
RB=1 : Counting in the p-register. Track no. is increased with 1.
RA=0 : Output of number of errors per track.
RA=1 : Output of number of errors totally only.
QB=0 : Output of the read and written bit pattern, track no. and word no. if error.
QB=1 : No output of the read and written bit pattern, track no. and word no.

By entry a normal adjustment is set intended for a routine test of tracks 1-319 and output only of the number of errors totally (cf. the instructions in cell 42). By installations with Three Drum Cabinet the instruction in cell 51 should be changed to: arn 959 D.

The only way to change the normal adjustment is to change the contents of the in- and p-registers manually and jump to cell 43. The program starts with the instruction ,zq 0 LKB, and stops only if the operator interferes.]

```
i= 41
[  41] zq              LKB        [ Stop if KB=1]
[  42] pi    7     ,pp            [ Normal adjustment. Start on track 1]
[  43] gp    53    ,hs    89      [ Jump to input of 3 numbers]
[  44] pt    61            t45    [ Initialising return jump to drum test]
[  45] hv    257   ,grn   76      [ Start adder test, clear error counter tot.]
[  46] pp    p1         LRB       [ Add 1 to track no.]
[  47] hs    187                  [ Store inputed numbers]
[  48] hv    155   ,hv    191     [ Fill track, store numbers]
[  49] grn   77    ,hs    187     [ Clear error counter per track, store numbers]
[  50] hv    164   ,hv    199     [ Read track, transfer numbers]
[  51] arn   319   D              [ If more tracks]
[  52] ncp         ,hv    46      [ then jump to new test]
[  53] pp          ,sy    64      [ else reset start track, write CR]
[  54] arn   76    ,hs    203     [ Jump to output of number of errors totally]
[  55] sy    64    ,hh    45      [ Write CR, jump to new test]
[  56] pt    61            V163   [ Entry interrupt drum test]
[  57] pt    61            t168   [ Entry interrupt drum test]
[  58] pm    195   ,arn   196     [ Reset R and M before]
[  59] gs    61    ,hv    290     [ jump to adder test]
[  60] gm    195   ,gr    196     [ Entry interrupt adder test]
[  61] ps          ,hh            [ Jump to drum test]
[  62] qq
```

```
[  63] qq                          [ Working cells]
[  64] qq
[  65] qq
[  66] qq
[  67] qq
[  68] qq
[  69] qq
[  70] qq
[  71] 0/1023/1023/1023            [ Constant]
[  72]      1                      [ Constant]
[  73] qq
[  74] qq
[  75] qq
[  76] qq
[  77] qq


                                   [ Subroutine, produce random test number]
[  78] pm    68                    [ From the numbers in cells 66, 67, and 68]
[  79] arn   68     X              [ 3 numbers are produced to be placed in the]
[  80] mk    66                    [ same cells. The contents of R is on exit]
[  81] sc    67                    [ depending on the contents of these cells]
[  82] dl    68     X              [ and used as a test number. Possibly]
[  83] ac    66          IOA       [ overflow is indicated in respective OA]
[  84] ml    67                    [ and OB for later check of flag bits.]
[  85] ac    68          IOB
[  86] hr    s1


                                   [ Subroutine, input of 3 numbers]
[  87]  0                          [ Working cell]
[  88]  10                         [ Constant]
[  89] pa    106            t62    [ Reset start cell]
[  90] pa    107            t2     [ Reset counting]
[  91] vy    17     ,sy     64     [ Select typewriter as I/O, write CR]
[  92] sy    34     ,sy     35     [ Write k, write l]
[  93] sy    49     ,sy     41     [ write a, write r]
[  94] sy    64                    [ Write CR]
[  95] pt    102            t106   [ Set jump address for positive number]
[  96] xrn          ,lyn    87     [ Clear M, input of 1 character]
[  97] nc    32     ,hv     100    [ If character ≠32 then jump]
[  98] pt   102             t105   [ else set jump address for negative number]
[  99] hh    96                    [ Jump to input of next character]
[ 100] ca    16     ,hvn    103    [ If character=0 then clear R and jump]
[ 101] ca    64                    [ If character=64]
[ 102] xr           ,hv            [ then exchange M and R and jump to storing]
[ 103] tk    -30    ,ml     88     [ else produce a decimal number in M]
[ 104] hh    96                    [ Jump to input of next character]
[ 105] mt    -1     D              [ If negative number then change sign]
[ 106] gr    62             t1     [ Store the decimal number in working cell]
[ 107] bt    2              t-1    [ Counter for input of 3 numbers]
[ 108] hv    95                    [ Jump within 3 numbers]
[ 109] hr    s1                    [ else exit]


                                   [ Subroutine, output of bit pattern from R]
[ 110] pa    121            t3     [ Prepare output in 4 groups]
[ 111] tl    -10                   [ Prepare output of 1 bit at a time]
[ 112] pa    118            t9     [ Prepare 10 positions in each group]
[ 113] mb    71                    [ Clear R pos. 0-9]
```

```
[ 114] tl    1                  [ Produce 1 bit]
[ 115] ca                       [ If it is 0]
[ 116] sy    16    V            [ then write 0]
[ 117] sy    1                  [ else write 1]
[ 118] bt    9          t-1     [ Counter for output of 10 pos.]
[ 119] hv    113                [ Jump back within a group]
[ 120] sy                       [ else write SP]
[ 121] bt    3          t-1     [ Counter for output of 4 groups]
[ 122] hv    112                [ Jump back within 4 groups]
[ 123] sy    1     V  LPA       [ else write ,1, or ,0, according to PA]
[ 124] sy    16                 [ which corresponds to bit 40]
[ 125] sy    1     V  LPB       [ Write ,1, or ,0, according to PB]
[ 126] sy    16                 [ which corresponds to bit 41]
[ 127] hr    s1                 [ Exit]


                                [ Subroutine, output of track no. and word no.]
[ 128] sy          ,sy          [ Write SP, write SP]
[ 129] sy    34    ,sy   49     [ Write k, write a]
[ 130] sy    37    ,sy   49     [ write n, write a]
[ 131] sy    35    ,sy          [ write l, write SP]
[ 132] arn   p     D            [ Prepare output]
[ 133] ck          ,tl   -30    [ of track no.]
[ 134] hs    203                [ Jump to output of track no.]
[ 135] sy          ,sy          [ Write SP, write SP]
[ 136] sy    38    ,sy   41     [ Write o, write r]
[ 137] sy    52    ,sy   37     [ write d, write n]
[ 138] sy    41    ,sy   59     [ write r, write .]
[ 139] srn   314   D            [ Prepare output]
[ 140] ar    170   ,tl   -30    [ of word no.]
[ 141] hs    203                [ Jump to output of word no.]
[ 142] hr    s1                 [ Jump back to error output]


                                [ Subroutine, error output]
[ 143] arn   72    ,ac   76     [ Add 1 to number of errors totally]
[ 144] ac    77                 [ Add 1 to number of errors per track]
[ 145] hv    180     LQB        [ If QB=1 then jump back without output]
[ 146] arn   69      IPC        [ else prepare output of test number]
[ 147] vy    16    ,sy   64     [ Select typewriter, write CR]
[ 148] sy    64                 [ Write CR]
[ 149] hs    110                [ Jump to output of bit pattern]
[ 150] sy    64                 [ Write CR]
[ 151] arn   (170)   IPC        [ Prepare output of read test number]
[ 152] hs    110                [ Jump to output of bit pattern]
[ 153] hs    128                [ Jump to output of track no. and word no.]
[ 154] hv    180                [ Jump back to next test]


                                [ Fill drum track]
[ 155] pa    158        t215    [ Reset start address]
[ 156] pa    159        t39     [ Reset counting]
[ 157] hs    78                 [ Jump to produce random test number]
[ 158] gr    215     MOC t1     [ Store result incl. flag bits]
[ 159] bt    39         t-1     [ Counter for 40 words]
[ 160] hv    157                [ Jump back within a track]
[ 161] vk    p     ,sk   216    [ else select actual track no., write on track]
[ 162] hv    56      NKB        [ Interrupt if KB=0]
[ 163] vk    p     ,hh   48     [ Exit]
```

```
                                         [ Read track and check]
[ 164] pa   180             t39          [ Reset counting]
[ 165] pa   170             t313         [ Reset start address]
[ 166] vk   p      ,lk   314             [ Select actual track no., read track]
[ 167] hv   57        NKB                [ Interrupt if KB=0]
[ 168] vk   p      ,hs   78              [ Jump to produce random test number]
[ 169] gr   69        MOC                [ Store test number incl. flag bits]
[ 170] sr   313             t1           [ Subtract read number]
[ 171] hv   143       NZ                 [ Jump to error output if R pos. 0-39≠0]
[ 172] hv   175       LOB
[ 173] hv   143       LB                 [ Jump to error output if OB=0∧b=1]
[ 174] hv   176
[ 175] hv   143       NB                 [ Jump to error output if OB=1∧b=0]
[ 176] hv   179       LOA
[ 177] hv   143       LA                 [ Jump to error output if OA=0∧a=1]
[ 178] hv   180
[ 179] hv   143       NA                 [ Jump to error output if OA=1∧a=0]
[ 180] bt   39              t-1          [ Counter for 40 words]
[ 181] hv   168                          [ Jump back within a track]
[ 182] hh   50        LRA                [ else if RA=1 then return jump]
[ 183] vy   16     ,sy   64              [ else select typewriter, write CR]
[ 184] arn  77                           [ Prepare output of number of errors per track]
[ 185] hs   203                          [ Jump to output of number of errors]
[ 186] sy   64     ,hh   50              [ Write CR, exit]


                                         [ Transfers of working cells]
[ 187] arn  63     ,gr   66              [ Storing of the 3 inputed numbers]
[ 188] arn  64     ,gr   67
[ 189] arn  65     ,gr   68
[ 190] hr   s1
[ 191] arn  66     ,gr   73              [ Storing of the 3 numbers produced by]
[ 192] arn  67     ,gr   74              [ passage of Produce random test number]
[ 193] arn  68     ,gr   75
[ 194] hv   49
[ 195] qq                                [ Working cells]
[ 196] qq
[ 197] qq
[ 198] qq
[ 199] arn  73     ,gr   63              [ Results for later use as start numbers]
[ 200] arn  74     ,gr   64
[ 201] arn  75     ,gr   65
[ 202] hv   51


                                         [ Output of number of errors]
[ 203] pa   210             t4           [ Adjustment for 5 digits]
[ 204] dk   215                          [ Transform to machine number]
[ 205] ar   214    X                     [ Possibly round off, exchange M and R]
[ 206] mln  213                          [ Prepare ]
[ 207] tk   30     ,ga   209             [ output of 1 digit]
[ 208] sy   16     V  LZ                 [ If digit=0 then write 0]
[ 209] sy                                [ else write digit]
[ 210] bt   4               t-1          [ Counter for output of 5 digits]
[ 211] hv   206                          [ Jump within 5 digits]
[ 212] hr   s1                           [ else exit]


[ 213]  10                               [ Constants]
[ 214]   1
[ 215]  100000
[ 216] qq                                [ 40 cells for the instruction sk 216]
```

```
i= 256                                        [ Simultaneous calculating by adder test 5]
[ 256] gr    309                              [ Only intended for corrections]
[ 257] arn   304     ,vy     16               [ Entry by start of adder test]
[ 258] gr               M                     [ Set address for floating-point overflow]
[ 259] pan   296     X          t1
[ 260] arfn  305
[ 261] grf   310
[ 262] arfn  306
[ 263] grf   311
[ 264] arfn  307
[ 265] grf   312                              [ Transfers of test numbers]
[ 266] arfn  308                              [ Adder test]
[ 267] grf   313
[ 268] arf   310
[ 269] mkf   311
[ 270] acf   312
[ 271] anf   313
[ 272] mlf   310     X
[ 273] scf   311
[ 274] srf   312
[ 275] mtf   313
[ 276] grf   310
[ 277] snf   311
[ 278] dkf   312
[ 279] gmf   313
[ 280] dlf   310
[ 281] ar    310
[ 282] mk    311
[ 283] ac    312
[ 284] an    313
[ 285] ml    310     X
[ 286] sc    311
[ 287] sr    312
[ 288] tl    -1
[ 289] hk    60         NKB                   [ Jump to drum test if transfer is finished]
[ 290] mt    313
[ 291] gr    310
[ 292] sn    311
[ 293] dk    312
[ 294] gm    313
[ 295] dl    310
[ 296] bt    1                  t1            [ Counter for 512 passages]
[ 297] hv    268                              [ Jump back within 512 passages]
[ 298] sr    309     ,ck                      [ else subtract result]
[ 299] sy    1          LZ                    [ Write ,1, if adder is ok]
[ 300] hv    259        LZ                    [ Jump to new test if adder is ok]
[ 301] zq               LKA                   [ Stop if adder error∧KA=1]
[ 302] sy    3                                [ Write ,3, if adder error]
[ 303] hv    259                              [ Jump to new test]
[ 304] hv    269
[ 305]  1234567890                            [ Test number]
[ 306]  2345678901
[ 307]  3456789012
[ 308]  4567890123
[ 309]  275/446/57/624                        [ Result of adder test]
[ 310]  0
[ 311]  0
[ 312]  0
[ 313]  0
[ 314]  0                                     [ 40 cells for the instruction lk 314]

e 41
```

[Test Program No. 14. Reader Test. 15/1-1965.

The program is to be used with an infinite 8-hole punched paper tape containing sets of characters with odd parity and values ranging from 0-127. Between each set of 128 characters there is about 1 inch of blank tape. Such tapes can be produced with Test Program A 206.

Input of the test tape should be started with blank tape and the program stops in case of error. When the START button is pressed, the program proceeds with the next character.

In case of error the character read is to be found in the R register and the character which it ought to have been in the p register. The p register can be altered manually during error stop.]

```
i=41
zq    LKB               ; stop if KB
zq    NKB               ; stop if not KB
vy                      ; choose reader
pm   127  D             ; set mask for bits 3-9
pp   1023               ; set first character to -1
lyn r-4,    pp p+1      ; read, add 1 to p
cm   p    D             ; compare
zq                      ; error stop
hv   r-3                ; jump
e41
```

Should it be impossible to input the test program by means of the reader, it can be done manually from the console by insertion of the following in cells 0-3:

```
[0]  lyn  2,    pp p+1; bits No. 8,19-22,24,25,31-35,38-40
[1]  cm p D           ; bits No. 20,24,25,28,29,32
[2]  zq               ; bit No. 25
[3]  hv               ; bits No. 20-22
```

Also the following must be inserted in the registers:

```
by = 0
M  = 127×10-9; bits No. 3-9
p  = 1023    ; bits No. 0-9
```

The test is started by a jump to cell No. 0 and the test is performed as described above.

[Test Program No. A 206.
Production of Tape for Reader Test No. 14. 15/1-1965.

Punches characters with the values 0-127 and stops. When the START button is pushed, the program is repeated.]

```
i = 10
vy  32                     ; choose punch
pa  r1     t 1023          ; set first character to -1
sy         t 1             ; print character  +1
bs  (r-1)  t 126           ; next order if 127
zq                         ; stop, jump to first character
hv  r-3                    ; jump to next character
e10
```

Beschreibung vom Programm R o o t s , das beim Übernahmetest von GIER angewendet wird.

Das Programm testet die Prozedur R o o t s , die sämtliche Komplexwurzeln in einem n'ten Grad Polynom Fn (z) mit Komplexkoeffizienten findet.
Das geschieht, indem man Nullstellen für $F(x,y) = |Fn(x + iy)|^2$ mit Hilfe einer Gradientmethode sucht.

Das Testprogramm, das ein ALGOL Programm ist, wird eingelesen und übersetzt, darauf werden die n (n=75) komplexen Zahlen, die nach dem Programm auf demselben Streifen stehen, eingelesen.

Das Programm generiert nun die Koeffizienten in diesem Polynom, welches diese Zahlen als Wurzel hat und wendet diese Koeffizienten als Parameter für R o o t s an. Die Lösung kommt als Ausgabe auf den Lochstreifenlocher.

Danach beginnt automatisch das Aufsuchen der Wurzeln im gleichen Polynom, und die Wurzeln von jedem Durchlauf können nun verglichen werden. Ein Durchlauf dauert etwa 40 Minuten.

Will man untersuchen, wie weit die Maschine in einem Durchlauf gekommen ist, drückt man K B und jedesmal wenn die Maschine eine Wurzel gefunden hat, wird sie - solange K B gedrückt ist - schreiben, wieviele Wurzeln noch zu finden sind.